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Electrical World

The Consolidation of Electrical World, Electrical Engineer and American Electrician

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A NEW METHOD

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BULLETIN NO. 985-W, issue of 1926, describes the new L & N Frequency Recorder, of which advance announcement was made in the 1925 N. E. L. A. Meter Committee report. Extremely sensitive, it records on a very open scale.

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 88 — *New York, Saturday, August 14, 1926* — NUMBER 7

One Measure of Efficiency in Regulation

FREQUENTLY mayors of cities and municipal authorities in cities owning and operating public utilities bring forward in testimony of work well performed some estimate of the savings made by the public owing to such municipal operation. These estimates may be and often are very wide of the mark, yet they suffice to soothe a gullible public too prone to accept such statements at their face value. "Ten years ago," they will tell you, "you paid 10 cents a kilowatt-hour for energy, whereas today, thanks to our efforts, you are paying five cents." Meanwhile, however, the art may have progressed to a point where five cents yields a greater profit than the price charged ten years ago. But the point is that the facts are accepted by the public as a measure of efficiency.

Driven to make some public statement to show that the Illinois Commerce Commission is serving the citizens of that state faithfully and efficiently, the chairman of the commission, Frank L. Smith, who defeated Senator McKinley in the Republican primary elections last spring, said that from January, 1922, to June 30, 1926, the public saved $78,425,803 through rate reductions, more than $41,000,000 of which affected Insull properties in and out of Chicago. The figures are his, not ours, so we cannot vouch for their accuracy; but, take them or leave them, the chairman of the commission offered them as a measure of his efficiency in office. It is not a good yardstick by which to measure efficiency. Under certain circumstances it may indicate oppression and confiscation; but men will offer it, and the public will reward them for it, however fallacious the premise and the conclusion may be.

Another Pioneer Passes Away

CHARLES D. JENNEY to engineers of the present generation is but a name. The older men in the electrical industry, however, know that it represents a mild-mannered inventor who years ago pioneered in the development of direct-current motors and systems of electrical control. His death last month in Indianapolis brings to mind that, while not perhaps so outstanding in his field as some of the more widely known men, Mr. Jenney was responsible for some very important developments in the electrical act.

When a very young man Mr. Jenney designed and built arc machines and arc lamps at Fort Wayne, Ind., and this business resulted eventually in the large factory now known as the Fort Wayne works of the General Electric Company. After leaving Fort Wayne he established, in 1885, the Jenney Electric Motor Company at Indianapolis, where he specialized in constant-potential direct-current apparatus. He was one of the first manufacturers to employ carbon brushes on his machines and was also one of the first to build small 500-volt direct-current motors, in which field he was pre-eminent at the time. Mr. Jenney was also among the first inventors to develop and apply direct-current motors to printing presses and typesetting machines. As a manufacturer Mr. Jenney built machines of a very high grade and in his generation did original work much of which is reflected in the direct-current apparatus of today. Some examples of his early work are to be found in museums, and while the art has passed him by, his contributions to it were noteworthy and commendable.

More Standardization in Voltages

THE light and power industry in this country has done a great deal to standardize system voltages by using multiples of eleven for high-voltage transmission. But there exists an opportunity to make a better standardization of voltages on apparatus installed, including the generator and even the utilization equipment. The drops normally occurring on the lines of a large system make it necessary to overexcite generators or to use lower than rated voltage on utilization equipment if standard generators and transformers are used.

Engineers of manufacturers and the apparatus committee of the National Electric Light Association have been working on this topic, and it is hoped that there will be a good discussion of it at the midwinter convention of the American Institute of Electrical Engineers. Already the manufacturers have put forth a plan which affords a basis for discussion. In this system it is proposed to retain the equivalent of the present four 2½ per cent taps in the transformer primary windings below rated voltage in step-down transformers. As regards step-up transformers for use adjacent to generators, it is proposed to equip them with the equivalent of two 2½ per cent taps in the primary windings below rated voltages to provide additional range for compensating for the voltage regulation of the transformers and to avoid overexcitation of generators. The general plan proposes that windings from which power flows shall have voltage ratings approximately 5 per cent greater than those at which power is received. This plan would make for little change in lower-voltage ranges, but would increase the voltage ratings of high-voltage generators about 5 per cent and would change the design of high-voltage transformers. Rated system voltages would become the rated voltage of the generator or of the secondaries of the transformers supplying the system.

This scheme has not been accepted as yet and is quoted as a suggestion worthy of study by all interested in getting better system standardization. It is encouraging to find engineers working on the subject in order to secure agreement on a standardization plan which would mean a great deal to the future economic development of the industry.

The Finsbury Technical School Closes Its Doors

AFTER a glorious history of almost half a century, Finsbury Technical College has been closed for want of funds. It gave no degree and was intended primarily to train students in the principles of science as applied to industry. Largely maintained by City companies until after the war, its only source of funds for the past five years was the London County Council. However, Finsbury will always be remembered for what it did and stood for in technical education.

Former students of Finsbury are to be found in positions of responsibility everywhere. Many great men were connected with its teaching staff, and it is only necessary to mention a few such as Professors Ayrton, Perry, Silvanus Thompson, Dalby and Eccles, all internationally known, to gain some conception of its standing among British institutions of learning. These men were able to inspire the ambitious youths of London; but when they died or retired Finsbury's attraction waned and, lacking the allurements of college life and the advantages of college degrees, it quietly passed out of existence. Its work is done, but its fame will endure.

Profitable Rate Adjustments to Amplify Service

TO REALIZE upon the opportunities for amplified service it is conceded that rate structures of many utilities must be changed to bring the inducement element into play. This opens the very complicated and delicate subject of rate making and introduces the question of where to stop with rate structure changes.

While every one agrees that a utility does a better job if it amplifies its service and improves its public relations, it is not easy to determine the exact rate form or to find out the profit or loss that will occur if rates are changed for each class of business. Studies have shown that the form of the rate rather than the price per kilowatt-hour is most effective in increasing service and revenue per customer, but in the application of this principle there is an economic and service balance to be determined for each business and for each utility.

For example, it may be argued that from a profit-making standpoint it is better to sell 300 kw.-hr. than 500 kw.-hr. for $25 to each residence customer. An "opinion" answer or the staple argument about the intangible value of good public relations helps the fact-studying type of executive little. A dollars-and-cents answer can and should be given, from which an executive decision can be made in terms of profit and loss.

An allocation of costs and a financial analysis based on the uniform classification of accounts will enable any utility executive to know this answer for any class of business. The investment responsibilities can be determined for each class of business. The load factors and the cost of the energy generated and the losses can be determined readily. A short tabulation of customer cost, readiness-to-serve cost, energy cost and income cost will show a total cost to serve each class of customers which can be balanced against the gross and net incomes in order to give the return on the investment. Only this kind of analysis can show where profit ceases in the use of an inducement rate or whether a higher consumption per customer for the same total gross income means greater returns on the investment. The utility executives have the salient facts available to make decisions intelligently, and there need be little guesswork in the development of intensified service on a profitable basis.

"Home Rule" Regulation a Fallacy

STATE regulation of public utilities has proved a splendid asset in their proper development. The rights of the public have been safeguarded, and yet opportunity has been afforded to organizers and executives to combine and interconnect utility properties in order to bring about economies. These savings have been passed on to the public. Since state boundaries are crossed, the growth of interconnection and the economies permitted by regional or group operation have led to a study of regulation on a sectional and even on a national basis.

Hence recent news that forty-five cities and towns in Illinois have formed an organization to curb the power of the Illinois Commerce Commission and to further the enactment of "home rule" legislation indicates a step backward in the development of regulation when measured from any angle. Under such regulation cases and costs would multiply and a multitude of local regulators would attempt to perform a task that calls for expert talent unbiased by local partisanship and operating with a state-wide and even regional perspective. Local political influences and local conditions would be made the basis of regulation for large utility systems whose greatest possibilities for better and cheaper service to the public lie in uniformity in operating rules and rates over a large territory. The great strides made by the electric light and power industry toward adoption of the same rates over a large territory, so that electric service of the same quality and quantity can be rendered to the public wherever the location, would cease. A multitude of rates based on local costs would bring back discrimination among the small towns and the farmers and the large cities where the load density is great. Rural service would be postponed indefinitely, and the whole industry would be limited in those developments which have enabled it to extend its service and lower its rates over a period of years. Advocates of "home rule" in utility regulation either have not studied the question deeply or are attempting to misguide the public for selfish motives.

Building Industrial Load by Attracting New Plants

SOME electric service companies are not only doing all they can to supplant isolated industrial plants by purchased power and to extend the use of electricity by existing industrial customers, but they are endeavoring also to induce new industrial plants to locate in their territory. The activity last mentioned becomes of particular benefit when few isolated plants remain for conversion, because additional business from existing customers cannot usually be obtained in such large blocks as business from new plants or from converted ones. Nevertheless, development of existing customers' consumption cannot and will not be neglected, because

it usually increases the load factor or the utilization of an existing investment.

Attracting industries to a territory served is not a new function for utilities. For years some of them have been co-operating with their local chambers of commerce to broadcast the advantages of their respective districts to new industrial plants so far as labor, railroad facilities, raw materials, living conditions, proximity of market and reliable, economical and adequate power are concerned. The last consideration naturally is emphasized by the utility companies. One of them has made a practice of collecting newspaper clippings from various parts of the country recording projects for expansion of the production or distribution facilities of industries, inadequacy of existing facilities, burning down of factories, labor troubles and similar facts, and of communicating with the industries concerned whenever a change of location appeared to be in contemplation.

One of the latest methods is that of showing real-estate companies that a new class of business can be developed by disseminating information on the industrial advantages of the communities. This method involves furnishing the real-estate men with information of the sort just mentioned, particularly concerning the reliability, adequacy and economy of power available. By so doing the utility company makes its problem of attracting new industrial plants also the interest of real-estate firms. The utility furnishes the information or the ideas, for which the real-estate firms are thankful, leaving them to execute the plans and thereby relieving itself of the detailed work and expense involved. Incidentally such co-operation is another method of building good will toward electric service companies, for the attraction of industry to a territory is a service to the whole community.

The Status of Kitchen Lighting

AN ELABORATE survey of the wiring and lighting of residences conducted in 1922 revealed enormous possibilities in revenue building by providing residential customers with the adequate utilitarian lighting of which they stood sorely in need. The kitchen presented one of the greatest opportunities, with little difficulty in the way of approach. A simple diffusing glass unit was devised and sold with a 100-watt clear lamp or a 150-watt daylight lamp. Chiefly by means of campaigns, at least a million kitchen units were installed in the homes of this country previous to 1924. In that year 106 central-station companies reported selling 333,000 kitchen units, and in 1925 45 companies reported selling 83,000 units. This means that at least fourteen hundred thousand units entered the kitchens in the past four years. If all data were available, the total would doubtless be more than two million. Even this great figure represents an average of only one modern kitchen-lighting unit for every seven residential customers. In other words, at the present time there are perhaps twelve million wired kitchens in need of such lamps.

From the viewpoint of added revenue the results will bear observation and comment. From the reports available the average kitchen unit increased the gross revenue $4.73 annually. All the units now installed have increased gross residential revenue about $9,000,000. On this basis, if every residential customer were supplied with a kitchen unit of the average wattage already sold, there would be an increase in residential revenue of approximately $70,000,000. This increased revenue would be nearly doubled if a 150-watt daylight lamp were used instead of a 100-watt regular lamp.

Reports from 150 companies which have conducted kitchen-lighting campaigns are almost universally enthusiastic over the results. Some have already sold kitchen units to as many as 28 per cent of their residential customers. All have noted a considerable increase in revenue, and many testify to an appreciable awakening of interest in lighting on the part of the customer. The modern kitchen unit is rapidly becoming a standard recommendation of electrical contractors, and it is raising the scale of lighting in other rooms.

Motor Rating Still Discussed

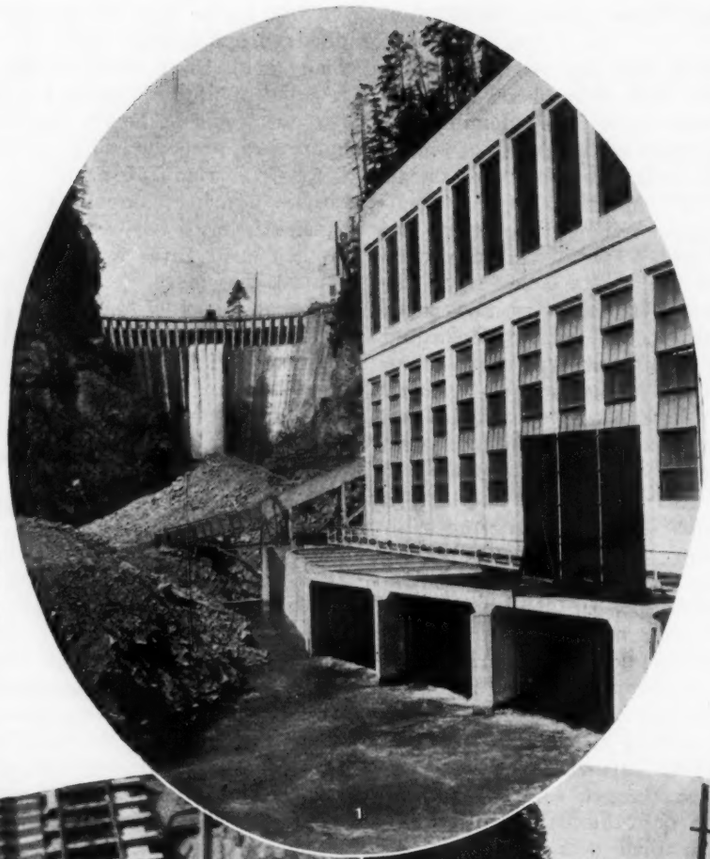
INDUSTRIAL motor rating is still a national and an international topic of interest. Two articles in this issue should be studied carefully by engineers and others interested in the subject. Clarence L. Collens outlines his personal views in logical sequence and proposes a definite plan. Exception may be taken to the arbitrary division of industrial motors whereby 200 hp. marks the difference between 40-degree and 50-degree ratings. The arguments for controlled and uncontrolled service conditions in this country based on size of motor can well be challenged. But, aside from this point, Mr. Collens' argument is sound and constructive.

Any motor sold should be sold on the basis of one standard rating, but additional data should be given whereby the motor can be applied intelligently. A rating of a motor is a nominal thing which serves to standardize manufacture and sale. It is a far cry from this market situation to the multitude of engineering applications to which a motor may be applied. If information is given which will enable an engineer to apply the motor intelligently and economically to the job, then no reason exists for its misapplication.

A different angle to the motor situation may be perceived by those reading the article by Professor Warner in this issue. This article shows test results on standard motors made by three different manufacturers and each having the same rating. The performance curves show that ample room exists for the play of competition between manufacturers. But the major results of the tests should be studied by those utility engineers who are debating the voltages to use on alternating-current networks. If 220 volts is departed from as standard service voltage, the standard motor would have some difficulty in serving its rated load. At 199 or 208 volts speed is affected appreciably and the breakdown or starting torque is changed. The 208-volt service is superior to that at 199 volts, and in most cases a standard motor would operate satisfactorily on the former; but for some application requirements and under certain duty-cycle operations care would have to be exercised if standard motors were used at the lower voltages. Thus the subject of standard motor rating under normal conditions has now been linked with the new network operations among debated features introduced by the great variety of applications of motors to industry. Much work remains to be done before agreement can be reached on a solution to the whole question.

Salmon Are Reconciled to Hydro-Electric Development

THE prevalent opinion that a salmon would refuse to climb a fish ladder where the difference in elevation was more than about 50 ft. has been overturned by the proved willingness of sockeyes on their journey upstream to the breeding places to climb and be assisted over the 265-ft. dam of the Puget Sound Power & Light Company on the Baker River in Skagit County, Wash. Later, when the young fish are hatched and ready to descend the stream, the little swimmers, six or seven inches long, joyously leap from crest to base and take no harm from their adventure.



No. 1. Baker River power house with the dam in the background

No. 2. Car and inclined railway that carry the fish to top of the dam.

No. 3. Fish ladder near the power house. Each fall is 2 ft. high.

Calculation of Short-Circuit Currents

Outline of Actual Procedure When Using Short-Circuit Board—Analysis of Results—Sources of Errors and Correction Factors

By RAYMOND C. R. SCHULZE
Engineering Department Duquesne Light Company, Pittsburgh, Pa.

CALCULATING tables or short-circuit boards are now being used quite extensively by operating companies throughout the country. Although employed chiefly for the calculation of short-circuit currents only, they may be used for other purposes as well. They have proved to be invaluable time savers, and in the case of modern complicated transmission systems they are an indispensable aid to the power system engineer.

It may be well to describe briefly the fundamental construction of a calculating table. It consists of a number of rheostats the values of which can be varied and some means of connecting these rheostats to represent the transmission lines, generators, transformers, etc. Each rheostat represents one part of the system or several parts that can be connected in series or parallel and represented as a single unit. Also, some means must be provided to measure the current in each rheostat.

The first step in the calculation of three-phase short-circuit currents by means of the calculating table is to prepare a map of the system to be studied. This map should show all lines, transformers, generators and reactors. Any synchronous machines comparable in size to the generators should be shown. Also, the arrangement of any substation buses that are constructed in an unusual manner should be shown. The resistance or reactance—whichever is higher—at the normal voltage of the line or other equipment should be marked on the map. If the resistance or reactance is not known to the one making the map, then the map should show, in the case of a line, the length, wire size and spacing, and in the case of a generator or transformer, the kilovolt-ampere rating and the per cent reactance drop at that rating. With these data the one making the study can easily obtain the reactance in ohms of the equipment in question.

The second step is to convert all reactance into reactances at the same voltage, by multiplying all values by the square of the quotient of the adopted voltage base divided by the normal voltage of the equipment in question. In this discussion it is assumed that the ohmic reactance method is being used. If a per cent method is used, all values are given as per cent voltage drop at a given load—say 10,000 kva.—at the normal operating voltage of the equipment. The map of the system is thus complete, with all reactance values on the same basis. If complicated, it may be worth while to redraw this map, to make it clearer and avoid mistakes.

This study can be made in two ways. Either assume all switches closed and thus get the maximum short-circuit current, or assume the actual running order and thus get short-circuit currents more nearly equal to those actually encountered. However, a slight change in running order may make a big change in the short-circuit currents possible at some points; also, the maximum current possible is the value desired. Therefore it is usually preferable to get the short-circuit currents possible with all switches closed. If time and conditions permit, both set-ups may be made.

If the number of lines, generators, transformers, etc., on the map exceeds the number of rheostats available on the calculating table, it is necessary to simplify the system as shown on this map. There are many places where lines in series, or parallel, or series-parallel, can be combined into one element. All radial lines or loops the ends of which come to the same bus section can be left off. This simplification, when complete, will give a map having no station bus with only two lines on it. As an example, a small part of a transmission system is shown in Figs. 1 and 2, both the actual lines and this same part simplified for application to the calculating table. This simplification is necessary in two cases—where the total number of lines is greater than the rheostats available on the

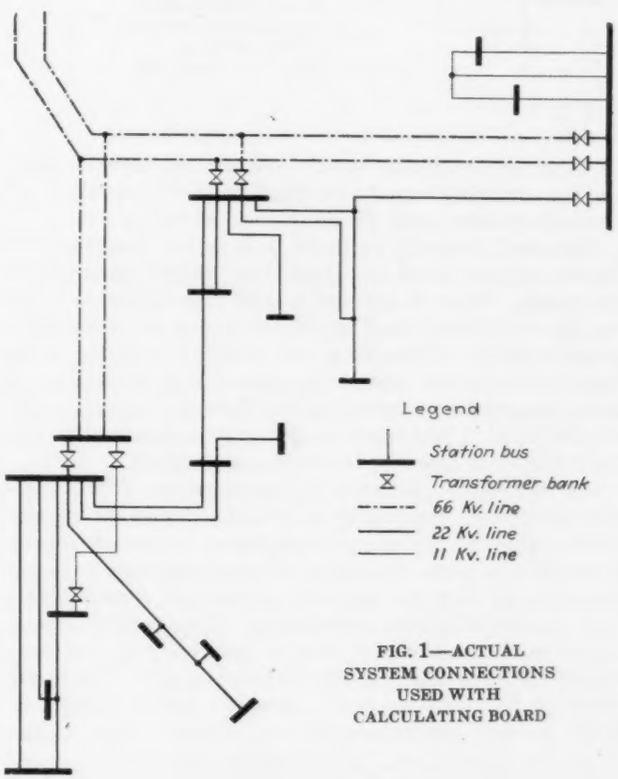


FIG. 1—ACTUAL SYSTEM CONNECTIONS USED WITH CALCULATING BOARD

calculating table, or where the computing is being done by slide rule only.

This simplified drawing is the one to be used when working on the calculating table. It will be found convenient to mark certain data on it. For instance, each element on the drawing can be given a number, to make sure there are sufficient rheostats on the table and also

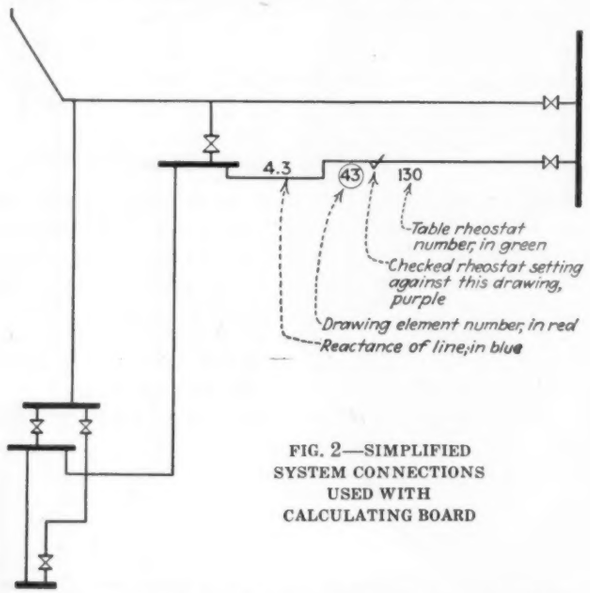


FIG. 2—SIMPLIFIED SYSTEM CONNECTIONS USED WITH CALCULATING BOARD

to facilitate checking later. Afterward each element on the drawing can be marked with the number of the calculating table rheostat that represents it.

The next step is to make a drawing showing the layout of the panel on which the various connections are made. Space is allotted to each substation or point on the simplified diagram where three or more lines come together. This step will result in a more intelligent use of the connection panel and will prevent unnecessary bunching of connections at certain parts of the panel. The various connections required to set up the system can now be made and checked.

As regards the settings of the rheostats, it will usually be found impossible to set the rheostats at the ohmic values of the elements on the drawing; therefore multiply the ohms reactance of each element by some constant, so that the greatest number of elements can be represented by single rheostats. There will no doubt be some cases where it will be necessary to put two rheostats in parallel, or two or more in series, in order properly to represent some extremely low or extremely high value of reactance. Where several values of the multiplier are possible, the highest value, or an even number such as ten, should be used.

TABLE I—TYPICAL SET OF READINGS TAKEN FROM CALCULATING TABLE

Rheostat No.	Junction Park 22-Kv. Bus — Table Amperes — Division	Scale	Amp.	Amp. at 22 Kv.	Actual Amp. at System Voltage	Power Station Data, Amp.
2	6.8	0.05	0.0034	360	360	11.3
4	7.5	0.05	0.0038	402	402	10.4
6	20.0	0.05	0.0100	1,059	1,059	12.9
						34.6*
30	89.5	0.05	0.0448	4,740	4,240	....
52	15.0	0.05	0.0075	794	794	....
	138.8/4					
	34.7*					
Ground (negative lead)	34.8*	0.02	0.0700	7,410	.....	....

* These three readings should check.

TABLE II—METHOD OF OBTAINING LOW REACTANCE VALUES

	1	2	3	4	5	6	7	8	9	10
1	0.50									
2	0.67	1.00								
3	0.75	1.20	1.5							
4	0.80	1.33	1.72	2.00						
5	0.833	1.43	1.875	2.22	2.50					
6	0.857	1.50	2	2.40	2.72	3.00				
7	0.875	1.56	2.10	2.54	2.92	3.23	3.50			
8	0.889	1.60	2.18	2.67	3.08	3.43	3.73	4.00		
9	0.900	1.636	2.25	2.77	3.21	3.60	3.94	4.24	4.50	
10	0.910	1.67	2.31	2.86	3.33	3.75	4.12	4.44	4.74	5.00

The writer has found it convenient to make up a table such as this:

Drawing Element	Location	Table Rheostat No.	Ohms	Units on Rheostat
1	Junction Park, 66/22 transformers.....	30	1.55	15

Where a large number of rheostats are used, it is easy to overlook one or two when setting them. Some positive means of eliminating this source of error must be used. The drawing of Fig. 3 is suggested. The "drawing element number" is not essential but can be added. By first setting all rheostats to zero, then setting the ones used to their proper value, the number not at zero can be checked against the number of drawing elements. The drawing of Fig. 3 provides a permanent record of rheostat settings in case doubt as to the actual setting should arise in the future. It is also a good idea to check the rheostat settings directly against the simplified drawing of the transmission system. This can be indicated on the simplified drawing by a small colored check mark on each element so checked.

All the checks on the set-up mentioned above may seem unnecessary, but it is better to find any mistakes that may have occurred before readings are taken rather than later. Also, making sure the set-up is correct gives added confidence in the results.

The next procedure is to take readings. From the simplified drawing make a list of the points at which a short circuit is to be assumed and the currents measured. Put after the name of each point the numbers of the table rheostats in which the current is to be measured. As each set of readings is taken, the numbers of the rheostats as taken from the simplified drawing can be checked against the numbers of the rheostats actually connected to that point.

1 54	9 11	17 76	25 15	33 5	41 8	49
2 56	10 76	18 5	26 38	34 1	42 4	
3 15	11 8	19 9	27 19	35 51	43 35	
4 44	12 13	20 45	28 13	36 9	44 14	
5 15	13 62	21 92	29 35	37 19	45 33	
6 20	14 11	22 46	30 15	38 24	46 43	
7	15	23	31	39	47	

FIG. 3—DIAGRAM FOR RHEOSTAT PANEL FOR RECORDING RHEOSTAT SETTINGS

A sample set of readings is given in Table I. Three sets of readings can be taken, all of which should total to the same amount. These are the currents feeding in to the point

of short circuit, the currents feeding out of the generating stations of the system and the direct-current supply to the board.

It is necessary to know the constants of the calculating table in order to convert the amperes read on the table into short-circuit amperes on the transmission system. This conversion can be done in this way:

	Symbol	Actual Value
Multiplier, drawing ohms to table units	m	10
Resistance, ohms per table unit	r	100
Direct-current voltage used on table	D	120
Volts to neutral on transmission system (at voltage base used for calculations)	E_n	12,700

I = actual current
I^1 = current as read
$I = I^1 mrE_n/D$
$= I^1 \times 10 \times 100 \times 12{,}700/120 = 105{,}900\ I^1$
for the particular values given above.

The results of a short-circuit current study of a transmission system should be presented in a report that gives all the data in such a way that they can be easily used by those interested. A sample sheet from such a report is shown in Fig. 4. A bus fault is assumed, and the current feeding in over each line is shown separately. The total current feeding in is shown as the "bus amp." The current feeding in to a line fault just outside the station is the "bus amp." minus the current feeding over that line in to a bus fault. The duty on any line circuit breaker can thus be determined. The maximum duty on a line breaker is listed as the "maximum line amp." At some substations, where the "bus amp." is high, another item, "per cent X," is listed. This refers to the time-delay correction factor, which is explained later.

Voltage drops in various parts of the system under short-circuit conditions can be obtained approximately by multiplying the current in any part of the system by the reactance of that part. This method will not give usable results where load currents are concerned. In this case, the actual load current and its division among the various feeders must be found by using volts drop per ampere at the power factor of each line in place of the reactance values of those parts of the system.

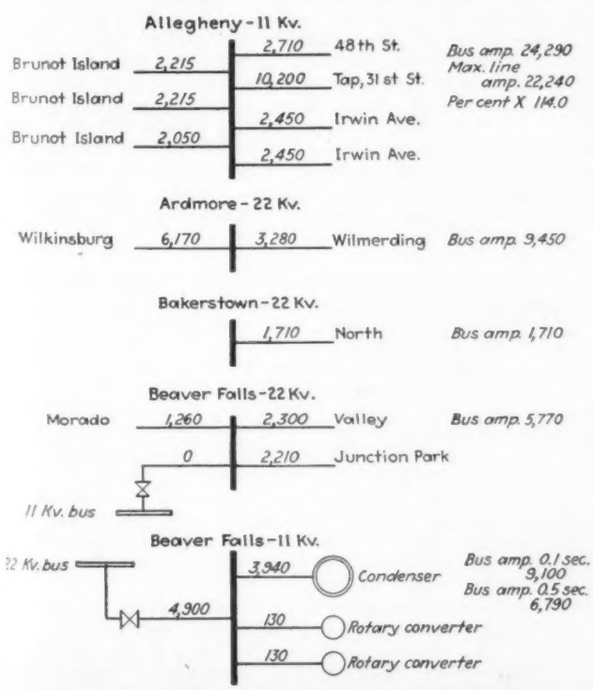


FIG. 4—METHOD OF MAKING UP REPORT SHEET

The voltage drops can be found by multiplying the load current by the volts drop per ampere value of that part of the system.

The discussion so far has assumed a balanced three-phase short circuit, which is the simplest case. Nothing will be given here on single-phase faults except the references to recent articles on line-to-neutral short circuits given in the footnote.*

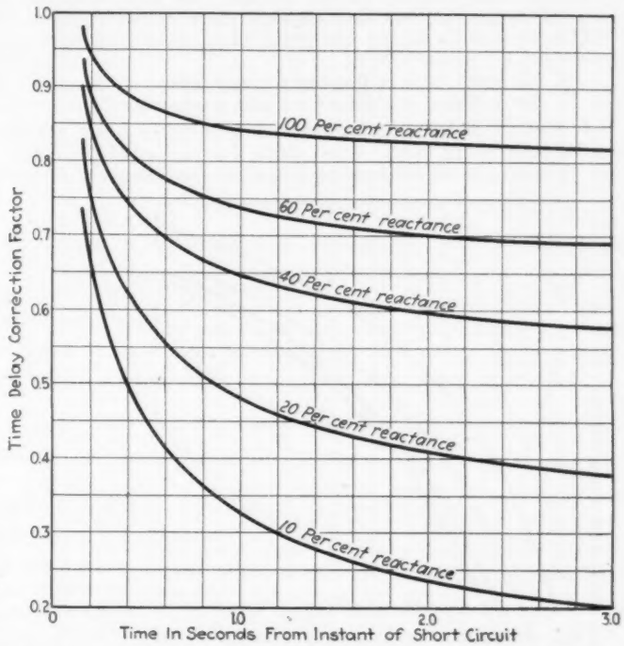


FIG. 5—TIME-DELAY CORRECTION FACTORS FOR THREE-PHASE SHORT CIRCUITS ON THREE-PHASE SYSTEM PLOTTED AGAINST TIME

There are a number of possible sources of error present in fault-current computation. Some of these errors can be corrected for, whereas others cannot. In any case the correction is approximate. The sources of error are of theoretical rather than practical value. Actually, a maximum value of the fault current is desired. The corrections, in general, decrease the current, therefore it is safer to neglect them. The easiest way to obtain the minimum current is to assume it equal to some fraction of the maximum. It cannot be calculated with any degree of accuracy, and it depends on the normal operating schedule of the system and the sequence of breaker operations in case of trouble.

Therefore a study of the sources of error is of value only in two ways: (1) Where the system conditions at the time of the fault are definitely known; (2) it gives a better idea of just what the computed current really is.

SOURCES OF ERROR

The following sources of error affect the accuracy of the computed value of short-circuit current:

1. Use of reactance instead of impedance.
2. Arc resistance.
3. Dissimilar ratios of transformation between two voltage systems at different points.
4. Variation of operating voltage.
5. Neglect of choke coils, reactance of buses, etc.
6. Accuracy of calculating table rheostats.

*"Finding Single-Phase Short-Circuit Currents on Calculating Boards," by R. D. Evans, ELECTRICAL WORLD, April 11, 1925.
"Calculation of Short-Circuit Ground Currents on Three-Phase Power Networks, Using the Method of Symmetrical Co-ordinates," by Sadatoski Bekku, *General Electric Review*, July, 1925.
"Single-Phase Short-Circuit Calculations," by W. W. Lewis, *General Electric Review*, July, 1925.

The following assumptions with reference to the generators and load currents must be made:

7. The generators to be running at no load.

8. The generator excitation to be such as to produce an electromotive force in the machines equal to the normal bus voltage at the instant the direct-current component of the short-circuit current disappears. This is usually about one-tenth of a second after the instant of short circuit.

9. No load current flowing on any lines.

10. No voltage regulators on the generators.

1. Use of Reactance Instead of Impedance.—An article by O. R. Schurig in the June, 1923, *Journal of the A.I.E.E.* on "Experimental Determination of Short-Circuit Currents in Electric Power Networks" contains a large amount of data on the accuracy of the calculations due to the use of the impedance or the reactance method. The reactance method gives results higher than the actual current, and the error is usually within 10 per cent.

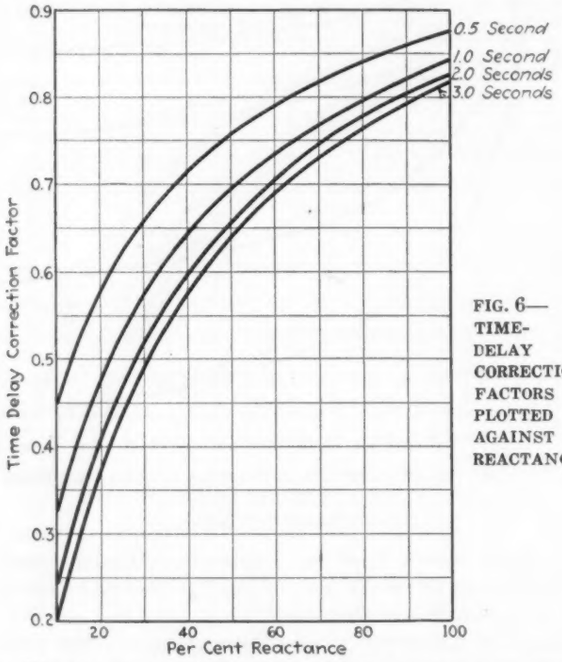


FIG. 6—TIME-DELAY CORRECTION FACTORS PLOTTED AGAINST REACTANCE

2. Arc Resistance.—The calculated short-circuit current assumes that the fault is a solid copper connection. Consequently in most cases, when the fault is a loose or dirty connection or an arc, some resistance is introduced into the circuit which reduces the fault current. This resistance is a very unstable quantity. It will depend on the current in the arc, the length of the arc, the material of which the conductor consists and possibly other factors. It can be determined only by experiment. As an example, it might be stated that in one case, on a 22,000-volt circuit when the "solid copper fault" current was around 9,000 amp., the arc resistance on a 3-ft. spacing reduced the current to about 90 per cent of its former value.

3. Dissimilar Ratios of Transformation.—On a large power system it is possible to have two voltage systems tied together at different points by transformers. On one system, for instance, the main transmission lines are operated at 66,000 volts; at various points there are transformer banks stepping the voltage down to about 22,000 volts. These 22,000-volt buses are tied together through other transmission lines. However, the ratio of transformation of each transformer bank is not 3 to 1; actually the ratio at one point is 2.9 to 1.00, at another 2.80 to 1.00, and farther away it is 2.70 to 1.00. Obviously, since all reactances must be put on the same voltage basis, the use of the actual voltage ratio at each transformer bank will cause some confusion. The only way out, when setting up the entire system, is to use the average ratio of transformation, or 2.80 in the above case.

4. Variation of Operating Voltage.—The voltages at the different substations will vary among themselves somewhat, and the voltage at each station will vary throughout the day, owing to load conditions and the lines in service.

5. Most companies place lightning arresters on their open-wire lines at each substation and insert a choke coil between the arrester and the bus. The reactance of this choke coil is small, and is usually neglected. Also the reactance of buses and ground connections is usually neglected. The author knows of one case where the short-circuit current on test was much less than the calculated value, due to the neglect of the reactance of connections inside the station.

6. Accuracy of Calculating Table Rheostats.—These rheostats are usually guaranteed to be within 3 per cent plus or minus of their rated value at all points. Also, since it is not usually possible to set them closer than to two places, the error between the reactance value and the rheostat setting may be as high as 5 per cent, as when the reactance is 10.5 and rheostat setting 10 or 11.

7 to 10.—Table II shows at what values to set two rheostats in parallel in order to obtain more closely a low reactance value. To illustrate, assume that the transmission system is operating normally and the generators are carrying full load at 85 per cent power factor. A short circuit occurs, which increases the kilovolt-amperes on the machines to 150 per cent of its former value, and the power factor of this total load drops to 50 per cent. The result is a drop in the induced electromotive force in the machines for two reasons—the change of the power factor to a lower lagging one and the increase in the armature current. This will reduce the induced electromotive force to somewhere near the same value as the bus voltage. It will be remembered that the normal bus voltage to neutral was used when calculating the short-circuit current. Thus assumptions 7 and 8 are partly compensated for by the change in the induced electromotive force in the generators under actual conditions.

Any load current flowing through the transmission lines will cause some voltage drop, which will thus reduce the voltage available to maintain the short-circuit current.

From this latter discussion it can be seen that a fully loaded generator will deliver more fault current than a lightly loaded one, due to the higher induced electromotive force in the fully loaded machine. However, a large load current reduces the voltage available to force the short-circuit current through the transmission system. Thus the effects of the load conditions tend to neutralize each other, and we may assume that the magnitude of the fault current is not seriously affected by the load on the system.

Armature demagnetization due to the heavy current in the generator windings has the greatest effect on the magnitude of the short-circuit current. Its effect is to cause the current to decrease rapidly for a short time—from about one-half second to two seconds, depending on the per cent reactance to the fault—after which the current assumes a steady value. This decrease in the current is shown by the time-delay correction factors in Figs. 5 and 6.

To use this correction factor, obtain the short-circuit current by the ohmic method. Then obtain the per cent reactance to the point of short circuit by dividing the full load kilovolt-amperes of all machines in use by the short-circuit kilovolt-amperes. Currents at the same voltage may be used in place of kilovolt-amperes. Next, refer to Fig. 5 or 6 and read the correction factor corresponding to this per cent reactance and the time required for the circuit breaker to open. Multiplying the total calculated fault current by this correction factor gives the corrected fault current after the specified time delay.

If the point at which the fault occurs is equidistant electrically from all power stations, then it can be assumed that the current over each line will decrease in accordance with the correction factor. However, if the fault is near one power station of a system having several power stations, then the current over one line will drop more rapidly than that over another line. For instance, in the case of a fault on a power-station bus, the current from the generators connected to that bus will drop to less than half the calculated value in half a second, but the current coming from other power stations on the system may be almost constant with respect to time.

It is assumed that no voltage regulators are in use, or at least that they will not operate quickly enough to boost appreciably the induced electromotive force in the machines. Since the voltage drop in the machines is taken into account, the induced electromotive force and not the bus voltage is the thing desired.

Rating of Industrial Motors

Cannot Be Divorced from Service Conditions—Industry Requires an Infinite Variety of Duty Cycles and Affords a Multitude of Service Conditions—Usual Service Conditions a Normal Basic Rating

By CLARENCE L. COLLENS
President Reliance Electric & Engineering Company, Cleveland, Ohio

THERE are three basic ideas that must be emphasized in a discussion of the rating of any class of electric motors:

1. Any basis of rating is at best merely an arbitrary designation of size. It is merely one of many that might be chosen.

2. Rating alone is insufficient and must always be supplemented by a clear definition of the service conditions for which the rating is chosen. In fact, determination of the usual service conditions must necessarily precede the determination of a suitable basis of rating.

3. Rating alone is an insufficient indication of the inherent abilitiy of the motor to perform satisfactorily under service conditions and duty cycles differing from the usual. It is merely one indication of size and must be supplemented by other service information to permit of intelligent selection and economic application.

The most generally recognized method of expressing size is what has been termed single rating—that is, indicating the horsepower load the motor will carry for a specified time without exceeding a specified temperature rise. No other load-time-temperature guarantees are given, and those specified for the best rating are a sufficient indication of size and give the simplest tests where required, and as the basis of guarantee between buyer and seller.

Acceptance of the principle of single rating does not, however, mean one standard or one yardstick for all classes of electrical apparatus or for all fields of application, the two variables being the time rating and the limiting temperature rise. The time rating varies with the known load conditions and duty cycle and may be either continuous or any one of several short-time ratings. The temperature rating may vary because of known or specified service conditions and does vary with the class of insulation used.

As emphasized in the beginning, rating cannot be divorced from service conditions. No one standard will do for all, and the basis of rating chosen for any particular class of motor or any particular field of application should be the one that best meets the greatest possible number of known duty cycles or that meets the usual service conditions for the majority of motors entering that particular field of power application.

Thus for railway motors we find a definite recognition of the space limitations and the cost of carrying dead weight in connection with the temperature limits chosen. Peak values of temperature rise in excess of normal operating limits are expected and the voltage variation in this class of service is taken into account. The final result is a particular type of motor designed for a particular field, chosen and applied with accurate knowledge of the service conditions and duty cycle. There is very little chance of misapplication or of a motor being taken off and applied to some other job with less intelligence or under entirely different service conditions. The same is true of crane motors and elevator motors.

Service Requirements Multitudinous

In the general field of industrial power motors the conditions are entirely different. Here are found an infinite variety of load duty cycles and wide variation in the service conditions. It is uneconomical to design a different type or class of motor for each application or duty cycle or for any particular set of service conditions, and this has naturally led to the design of a standard stock industrial power motor having characteristics that make it suitable for a great variety of applications and service conditions.

Even though suited and designed for a wide range of applications, the general recognition of only one standard for indicating the size of any given motor is very desirable. This should be the continuous-duty rating of the open-type motor for operation under the clearly defined usual service conditions. This is the normal or basic rating and should also be recognized as the basis for nameplate marking, the rating to which all performance guarantees apply and the measure of the financial responsibility between buyer and seller.

Fractional-horsepower motors are already recognized as a distinct class in rating specifications. Careful consideration of the usual service conditions of industrial power motors of 1 hp. and larger also justifies recognizing two other distinct classes, with the dividing line at about 200 hp.

Specifications for Usual Service Conditions

In the class of industrial power motor from 1 hp. to 200 hp. the usual service conditions include:

1. An ambient temperature not exceeding 40 deg. C.

2. Voltage variation not exceeding 10 per cent plus or minus from normal.

3. Frequency variation not exceeding 5 per cent plus or minus from normal.

4. A combined variation in voltage and frequency not exceeding 10 per cent plus or minus.

The variations in voltage and frequency are necessary in order to allow for the variation from normal on power service lines at a distance from or near the generating unit or between the extremes of light and peak loads, and should not be interpreted as justifying service voltages designed to give normal voltages varying appreciably from the generally recognized standards.

Other usual service conditions for this class of motor

which do not permit of exact definition but which must be recognized are: Inability always to determine exact load requirements, the presence of dirt and dust, ultimately tending to clog windings and restrict ventilation, and the absence of competent supervision in the great majority of small industrial plants.

To meet the usual service conditions thus defined, a 40-deg. C. limiting temperature rise has been chosen as the basis of the normal continuous-duty open-type rating. This is the limiting temperature rise when tested under rated load at rated voltage and frequency and gives the necessary leeway for operation within safe temperature-rise limits under the usual service conditions as defined above.

Other service conditions, which must be defined as special for the class of industrial power motor from 1 hp. to 200 hp., include operation at rated voltage and frequency, competent supervision, clean locations and definitely known load conditions. These are more favorable than the service conditions defined as usual, and where they exist the inherent ability of an industrial power motor to carry increased loads must be made available. When operating at normal voltage and frequency a loading 1.15 times the normal 40-deg. rating is permissible.

Industrial power motors of the second group or class, in sizes above 200 hp., are usually found on individual drives where the load conditions are definitely known, in clean locations, under competent supervision or on power mains where extreme variations in voltage and frequency are not to be expected. In fact, the usual and special service conditions for the second class are reversed as compared with the first group and fully justify the 50-deg. C. temperature rise limit for the second as compared with the 40 deg. C. for the first. Where the large motors of 50-deg. C. rating are installed under the less favorable service conditions, the permissible loading must be decreased as compared with the nameplate rating.

Two Classes of Service Ratings

British manufacturers and the British Engineering Standards Association also recognized the necessity of dividing power apparatus into two classes, with the 50-deg. rating for the large apparatus and the 40-deg. rating for the smaller industrial machines. C. Rodgers, in a paper read before the International Electrotechnical Commission as justifying this, speaks of the service conditions of the large apparatus as "controlled" and the less favorable service conditions of the smaller industrial machines as "uncontrolled."

In the United States industrial power motors with the 40-deg. rating from 1 hp. to 200 hp. have been commonly termed general-purpose motors. These are no more general-purpose motors than the larger motors with 50-deg. rating, as the latter are in no sense of the word limited to some single type of application in some special field, as in the case of railway or crane motors. The distinction is not in the wider, more general application of the one as compared with the other, but merely that because of the actual conditions to which the greater number in each class are subjected, the normal rating of the large motors is based on the more favorable "controlled" service conditions and of the smaller sizes below 200 hp. on the less favorable "uncontrolled" service conditions.

In each class, either above or below 200 hp., it is uneconomical to manufacture and carry two lines of motors, one on the 40-deg. basis for uncontrolled service conditions and the other on the 50-deg. basis for controlled service conditions. One line of motors in each class, with a clear statement of the service conditions to which the normal rating applies and service factors indicating the permissible loading for other service conditions or other duty cycles, is not only economical but gives ample flexibility for intelligent selection and proper application.

Differentiating between service conditions for continuous-duty loading is not the only information that should be made available for the intelligent selection and economical application of industrial power motors. Large numbers of such motors are applied to varying duty with a wide range between the minimum and maximum load conditions, the maximum sustained load being carried for only short periods of time. A service factor might very properly be determined and applied to the 40-deg. open-type continuous-duty motor when used for driving a machine tool under the conditions of the customary one-hour machine-tool service.

An industrial power motor gains no additional significance or inherent capacity by taking off the standard 40-deg. size designation and putting on a new nameplate marked with an increased horsepower rating for either more favorable service conditions or for some short-time duty cycle. It is far preferable to have the normal continuous-duty rating as the size designation on the nameplate and then by means of service factors apply motors to different service conditions and varying or short-time duty cycles. There is then less chance of misapplication as motors are shifted from one job to the next.

Purchasers of structural steel, say a 4x3x½-in. angle, find easy reference tables showing just what loads it will carry as a column of different lengths, or as a beam with either side down and with a load distributed or applied at one point, or as a tension member pure and simple. This is service information and permits of proper intelligent application. Purchasers of a 7½-hp. 40-deg. C. industrial power motor must similarly have available for the convenience and use of qualified persons service information that will permit of the proper application of the standard motor to various duty cycles and service conditions.

Program for Motor Rating

Briefly summarized, a logical, practical program for the rating and economic application of industrial power motors contemplates:

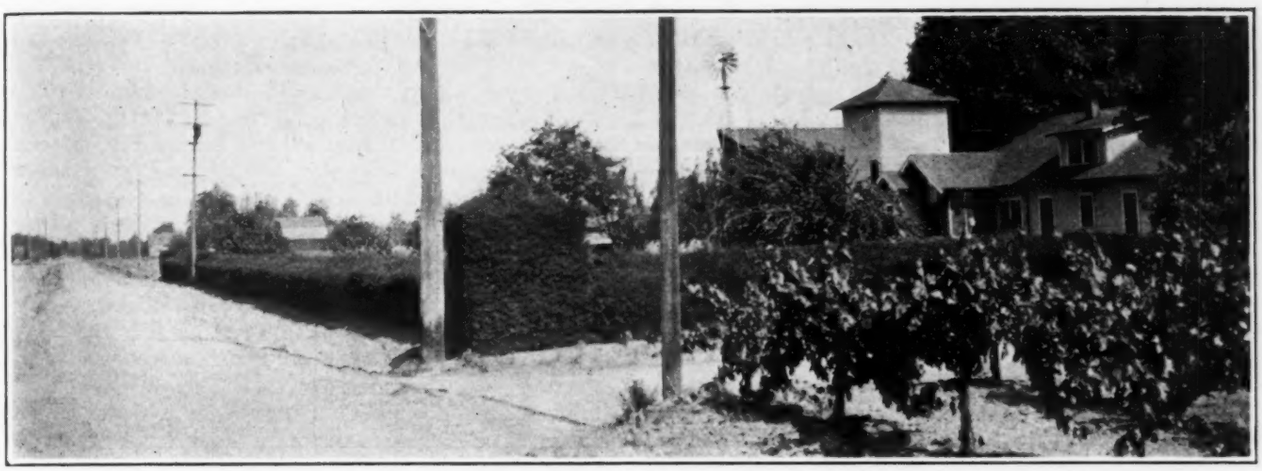
1. The division of industrial power motors into two classes with the dividing line at 200 hp. and in each class:

2. A normal continuous-duty single rating for the open-type motor as the standard designation of size.

3. Well-defined usual service conditions for the normal rating.

4. Service information showing permissible loadings under other duty cycles or other service conditions differing from the usual service conditions.

5. Specialized motors with special ratings only where the performance characteristics required or the nature of the duty cycle do not permit of applying a service factor to the normal rating of the standard motor.



ONE OF THE BETTER FARM HOMES IN THE TURLOCK IRRIGATION DISTRICT OF CALIFORNIA. THIS HOME IS COMPLETELY EQUIPPED ELECTRICALLY WITH LIGHTS, RANGE, AIR HEATING, REFRIGERATION AND APPLIANCES

Developing Household Electric Heating Load

Irrigation District Turns to House Heating to Dispose of Surplus Power from Irrigation Power Project—Characteristics of House-Heating Load

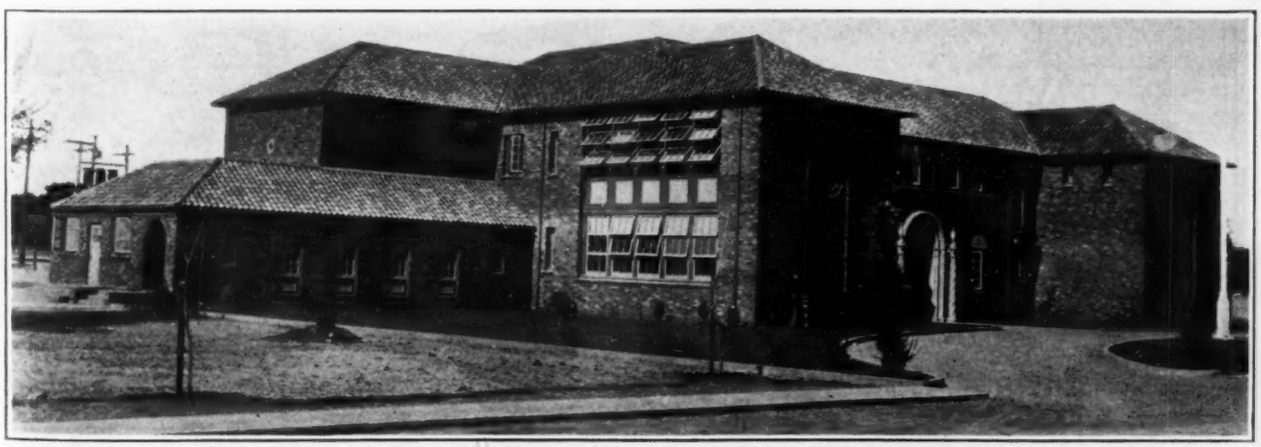
By L. H. PARKER
Assistant Superintendent Electrical Department, Turlock Irrigation District, Turlock, Cal.

UPON completion of a 15,000-kw. hydro-electric plant in connection with an irrigation project in 1923, the problem of the Turlock Irrigation District was to develop a load of sufficient magnitude to warrant building and maintaining lines in sparsely settled areas. The district comprises 181,000 acres of land with a total population of approximately 20,000 in the San Joaquin Valley of California and includes the town of Turlock.

Electric cooking was given first consideration as a load builder and has been developed to a saturation of 23 per cent within three years and is still increasing. Electric house heating also offered possibilities, although it appeared rather difficult in view of the fact that all farms usually have trees and brush available in sufficient quantities to provide the necessary fuel for heating in the mild California winter, the temperature of which rarely goes below 30 deg. F. and never below 20 deg. F., and then only for one or two days at a time. However, it seemed reasonable that with the proper rate and correctly installed equipment the great convenience of electric heat would enable a reasonable amount of this business to be developed. Accordingly a rate was fixed that averaged about 1¼ cents per kilowatt-hour. This brought the cost of electric heating to a point where it was comparable with other methods of heating and yet allowed sufficient profit under existing conditions to make the load highly desirable.

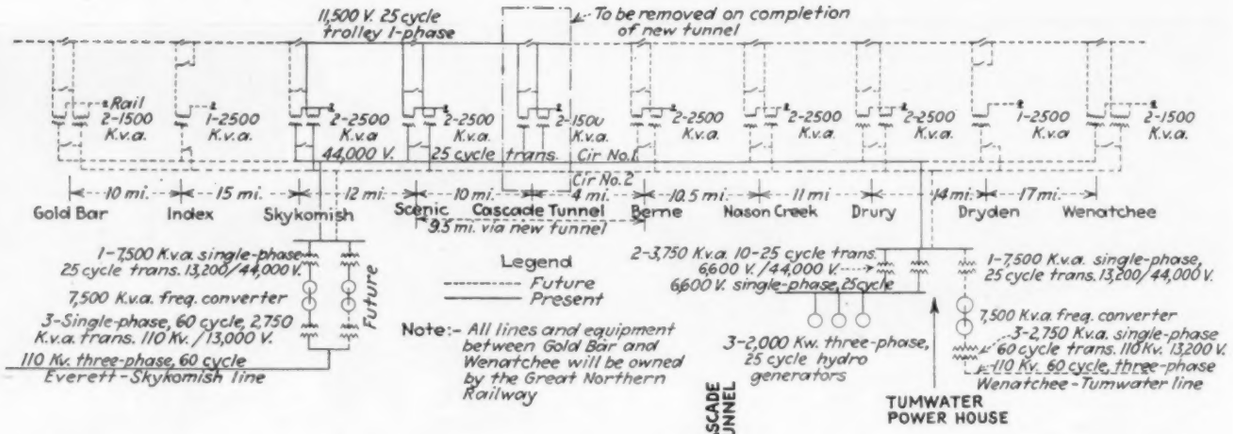
As there seemed to be no definite information available regarding the correct proportionment of heater size for the climate prevailing in this section, many tests were run to obtain the desired data. From these data it was found that an average figure of 1.5 watts per cubic foot of room volume gave satisfactory results for the average home. For rooms having northwest exposures on two sides, this being the direction of the prevailing winter winds, or having other features detrimental to the retention of heated air, this value of 1.5 watts per cubic foot sometimes had to be increased to 3 watts per cubic foot.

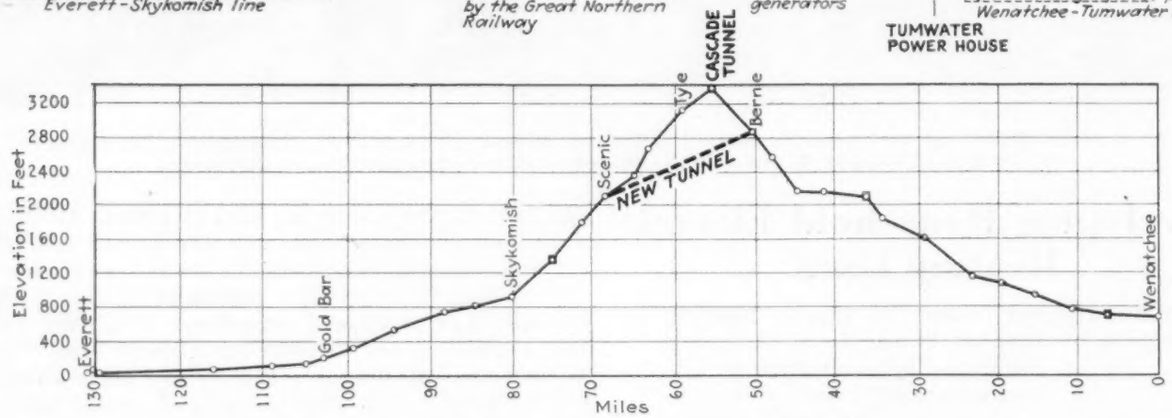
Heaters of the type that heat the air directly have been found to be superior to types using an intermediate medium, such as water or steam, to transfer heat from the element to the air. Also heaters giving off a small proportion of radiant heat in addition to convection heat are more satisfactory than the straight con-

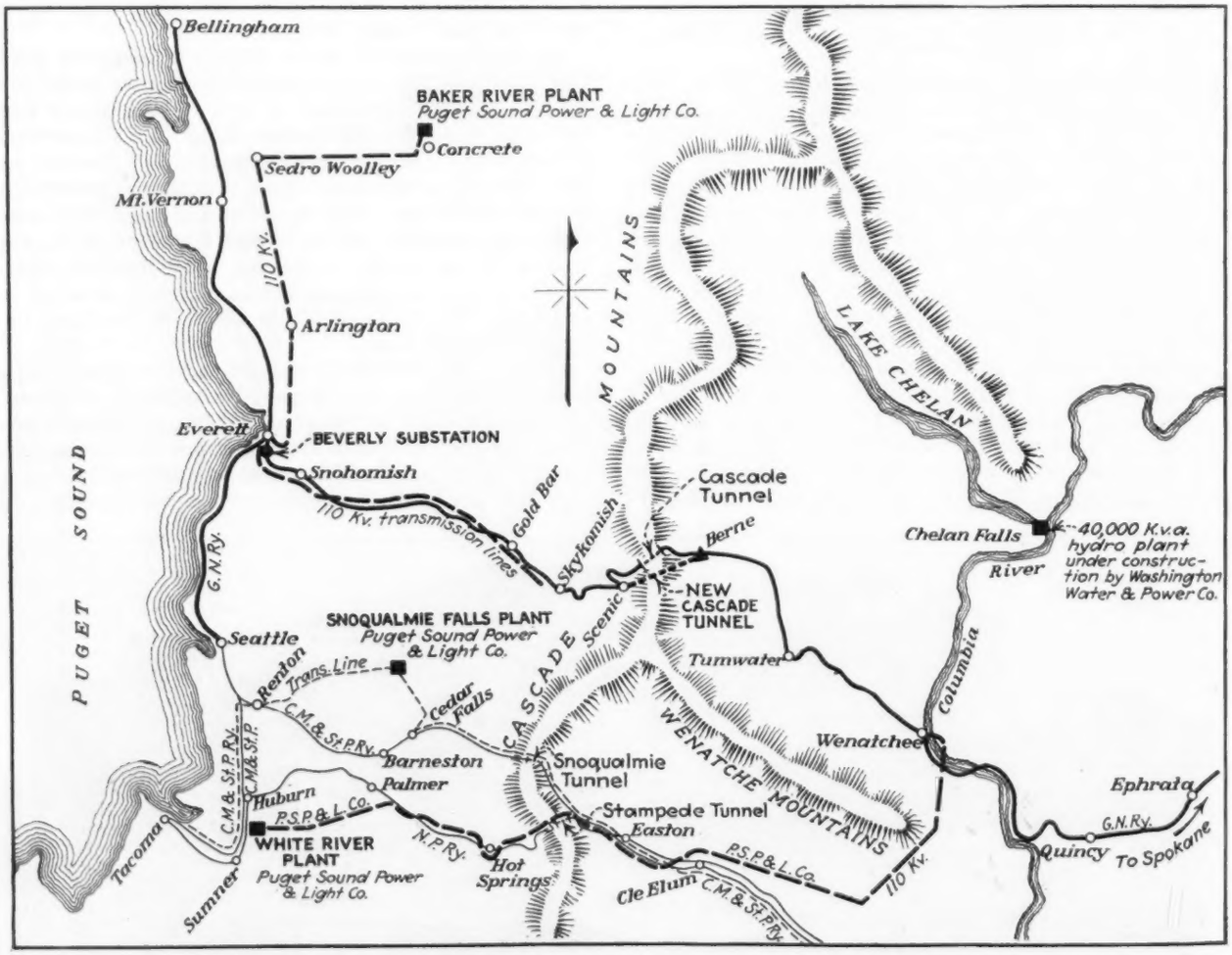


GRAMMAR SCHOOL IN SAN JOAQUIN VALLEY HEATED BY ELECTRICITY. INSTALLED CAPACITY OF HEATERS 192 KW.

Essential Features of Great Northern Electrification in the Northwest







AT TOP—SINGLE-LINE DIAGRAM SHOWING ESSENTIAL FEATURES OF GREAT NORTHERN RAILWAY ELECTRIFICATION. IN CENTER—PROFILE OF GREAT NORTHERN RAILWAY FROM EVERETT TO WENATCHEE. AT BOTTOM—MAP OF EVERETT-WENATCHEE SECTION OF GREAT NORTHERN RAILWAY

vection or largely radiant types. Heaters having more than one heat are more desirable than those having an "off" and "on" position only.

For average domestic conditions in the Turlock district about 1,500 kw.-hr. per kilowatt of installed heater capacity is required for the season's operation. When the electric heater load was first considered, there seemed to be no reliable data available as to load and demand factors, time of heating peak, etc. Therefore after a sufficient number of consumers of this class had been connected a series of tests was run during the winter months by installing graphic ammeters for periods of at least 24 hours and assembling these charts from various consumers on days of approximately the same minimum and maximum temperatures. Consumers' load curves, so obtained, were combined into totalizing load curves, from which it was determined that with a total connected load of lights, ranges, water heaters and space heaters amounting to 198 kw. the maximum combined peak was 51 kw., or 25.8 per cent of the connected load (the time of maximum peak being about 8 o'clock in the morning). The ratio between individual maximum demand and connected load amounted to 44 per cent, and the average individual daily load factor was found to be 36½ per cent. The evening residential peak load occurred at 6 p.m. and amounted to 21.2 per cent of the connected load.

To date approximately 1,600 kw. of heating load has been connected, which is a ratio of 1 kw. to every three customers. Rural schools also have found electric heating very advantageous, not only through lessened fire hazard but from the standpoint of economy as well, as the electric system with its distributed individual units gives heating flexibility and also eliminates the janitor expense attendant on furnace heating.

The great development of heating load in a comparatively new territory has probably been due partly to the fact that the climate encountered is ideal for electric heating purposes and also to the degree of co-operation existing between the residents of the Turlock Irrigation District as power users and the district itself as a power producer, having energy available as a byproduct.

Great Northern Electrification Plans

Single-Phase Motor-Generator-Type Locomotives Adopted—Main-Line Electrification Over Cascades to Cost More than Three Millions—Northern Pacific Studying Electrification

ELECTRIFICATION of 25 miles of main line of the Great Northern Railway from Skykomish to Cascade Tunnel, Washington, is now under way, and operation is scheduled to begin about Jan. 1, 1927. This constitutes the first step in a program that will be prosecuted diligently until 96 miles of main line, via the new tunnel over the Cascade Mountains in western Washington, from Gold Bar to Wenatchee, is electrified, at an estimated cost of more than $3,000,000. Savings in operating costs effected by electric operation are calculated to bring a return of 15 per cent on the investment.

Plans for electrification of the Great Northern have perhaps attracted more attention among railway men and electrical engineers than any other major electrification yet undertaken, because of the system adopted. Recognizing the advantages of alternating-current transmission and trolley and the superiority of direct-current traction motors, engineers and officials of the road chose the motor-generator type of locomotive, which will take power from an 11,500-volt, single-phase, 25-cycle trolley. By using motor-generator locomotives it is possible to take advantage of the inherent merits of both the a.c. and the d.c. systems—that is, high-voltage transmission to the locomotives with minimum amount of copper and power loss, static unattended transformer stations along the railway line, light overhead construction, plus the advantages of d.c. traction motors and practically unlimited flexibility of control in operation and regeneration. Ralph Budd, president of the Great Northern, was one of the first to suggest the motor-generator type of locomotive, and he is a strong advocate of the system.

There were many reasons for the use of 25 cycles as against the standard commercial frequency of 60 cycles, important among which is the fact that there is far less interference with communication circuits at 25 cycles than there is at 60; 25 cycles is standard for railway transformers and much other equipment has already been developed; 60 cycles would have required a copper ground return, on account of the higher impedance of the rails; regulation of a 25-cycle system is much better on fluctuating railway loads and losses are less than at 60 cycles; furthermore, some kind of rotating equipment would have been required in any event to convert the single-phase railway load into a balanced three-phase load on the power system supplying the energy, and besides it was desired to make use of the capacity of a 6,000-kw. hydro-electric plant at Tumwater, which generates at 25 cycles and which is owned by the railway company. The generators here are three-phase, but tests show that owing to the liberal design of the machine it will be possible to get full nameplate rating at single phase.

The Great Northern has contracted with the Puget Sound Power & Light Company to supply all power necessary for the electrification, and under this agreement the Tumwater plant will be operated by the power company and tied in with its system through a 44-kv. railway transmission line at present and later possibly through its 110-kv. transmission line going by another route over the mountains to Wenatchee.

Work now under way includes construction of a 110-kv., three-phase, 60-cycle transmission line from the Beverly substation of the Puget Sound Power & Light Company, near Everett, Wash., to Skykomish; installation of a frequency-changer set at Skykomish substation; railway transformer stations at Scenic and Cascade Tunnel; a 44-kv., single-phase, 25-cycle transmission line along the railroad right-of-way from Sky-

komish to Tumwater, and the erection of the trolley or contact system. This is shown at the top of page 320, and from this illustration also may be seen the next step in the electrification which will follow immediately—that is, Gold Bar to Skykomish and Cascade Tunnel to Wenatchee. The center and bottom drawings on page 320 give respectively a profile and plan of the railway from Everett to Wenatchee. The first section, from Skykomish to Cascade Tunnel, when completed, will involve an expenditure of approximately $1,750,000, which includes two locomotives. Electrification of the two other sections will cost approximately $1,250,000, including two more locomotives.

Four locomotives are now on order, two from the Westinghouse Electric & Manufacturing Company and two from the General Electric Company. The Westinghouse locomotives are of the two-cab type, rated at 88,000 lb. continuous tractive effort at 15 m.p.h.; the General Electric locomotives are of the single-cab type, each rated at 54,000 lb. continuous tractive effort at 16.5 m.p.h. Four or five additional locomotives will be required upon completion of the entire section from Gold Bar to Wenatchee. One of the Westinghouse locomotives is practically completed, and both will be ready for delivery about Nov. 1 of this year. Delivery of the General Electric locomotives will be made at a later date.

TRANSFORMER AND MOTOR-GENERATOR USED ON WESTINGHOUSE LOCOMOTIVES

The important electrical features of the Westinghouse locomotives are shown diagrammatically in Fig. 1. It will be seen that from the contact line 11,500-volt, single-phase, 25-cycle current is first taken through an oil switch and thence to a 1,500-kva. transformer, stepping down to 1,200 volts for the operation of a 2,100-hp., single-phase synchronous motor, driving a 1,500-kw., 600-volt d.c. generator. An exciter will be mounted on each end of the main shaft of the motor-generator set. One will provide excitation for the synchronous motor and the d.c. generator and the other will be a special exciter for exciting the shunt fields of the traction motors while being used for regeneration. The whole scheme is designed to use regenerative braking to pump power back into the transmission system, and frequency changers will be provided with automatic field regulators to take care of the reversal of power during regeneration.

Three frequency-changer sets will be supplied by the General Electric Company, one to be installed, for the present, at the Skykomish substation and later a second set at this same station, with the third either at Tumwater or Wenatchee. Owing to the fact that two widely separated 110-kv. lines of the Puget Sound Power & Light Company will be tied together through these frequency changers, it is necessary that the machines be provided with motor-operated stator shifters to compensate for the difference in phase angle and to control the load on the machines. Another feature of the frequency-changer sets will be the mounting of the stator on heavy springs to reduce vibration from the single-phase generators.

A single wooden-pole line along the track will serve to carry the two 44-kv. railway transmission lines and to support the trolley mast arms. A typical pole on a tangent section is shown in Fig. 2. The contact line is No. 4/0 cadmium bronze supported by the inclined catenary type of construction. The Great Northern has

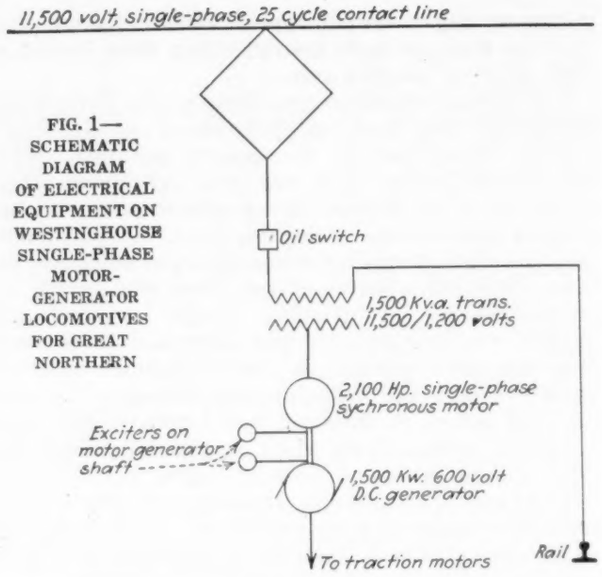

11,500 volt, single-phase, 25 cycle contact line
Oil switch
1,500 Kv.a. trans. 11,500/1,200 volts
2,100 Hp. single-phase synchronous motor
Exciters on motor generator shaft
1,500 Kw. 600 volt D.C. generator
To traction motors
Rail

FIG. 1—SCHEMATIC DIAGRAM OF ELECTRICAL EQUIPMENT ON WESTINGHOUSE SINGLE-PHASE MOTOR-GENERATOR LOCOMOTIVES FOR GREAT NORTHERN

contracted with the division of construction and engineering of Stone & Webster to build the 44-kv. railway transmission line, that portion of the 110-kv. circuit, from Gold Bar to Skykomish, which will be owned by the railway company, and the contact line and catenary system. Stone & Webster are also erecting the 110-kv. line for the Puget Sound Power & Light Company from Beverly substation to Gold Bar.

Interference with signal and communication lines due to the single-phase railway system has been given

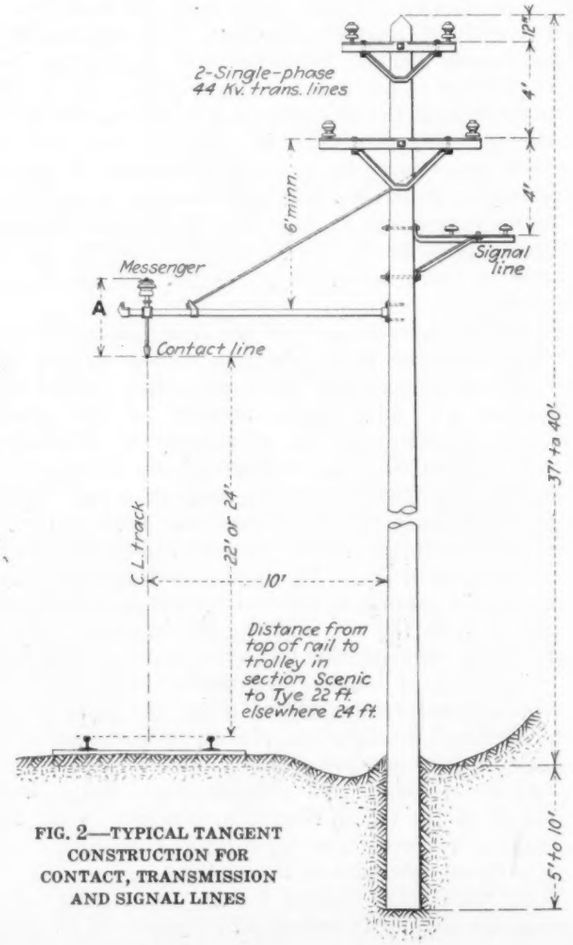


FIG. 2—TYPICAL TANGENT CONSTRUCTION FOR CONTACT, TRANSMISSION AND SIGNAL LINES

careful consideration. The d.c. signal system will be changed to a.c. 60 cycles with 6,600-volt transmission. There will be a general revamping of telegraph and telephone lines along the right-of-way, and in places necessary cable will be used. In other cases the lines will be moved entirely off the right-of-way. Local telephone lines near the railway will be moved far enough away to avoid inductive troubles. The problem of inductive interference has been attacked on the basis of distance as being the most effective remedial measure.

Metering presented some interesting problems to the power company owing to the fact that the contract calls for the simultaneous measurement of demand at two widely separated points, and besides, it is necessary to take into account power fed back into the power company's system by the Tumwater plant and by the locomotives when regenerative braking is used. Power will be metered by two three-phase ratchet meters at each point and demands will be measured by graphic meters driven by Warren clocks to obtain simultaneous measurements at the two points. The power contract between the railway company and the Puget Sound Power & Light Company calls for billing on the basis of the average of the three highest five-minute demands during the month. In the event of power failure any peaks occurring during the first fifteen minutes after service is restored are to be ignored. Owing to the fact that all power taken by the railway from the Puget Sound Power & Light Company's system will first have to pass through frequency changers, driven by synchronous motors, it will be possible to maintain unity power factor or a leading power factor if desired.

PRESENT ELECTRIC OPERATION

The Great Northern Railway now operates two three-phase, 25-cycle locomotives through its present 2.6-mile Cascade Tunnel, and these will be discontinued upon completion of the first electrified section under the present program. Work is now under way on a new tunnel under the summit of the Cascades, which will eliminate 500 ft. of elevation and shorten the track mileage by 7.68 miles. This tunnel, which is the longest railway tunnel yet to be constructed in this country, will be completed in about two years. It will be 7.79 miles in length, 16 ft. wide and 20 ft. 10 in. in the clear above the rails. Electric power is being used throughout in its construction.

Upon completion of the mountain division, from Gold Bar to Wenatchee, the next logical step in the electrification of the Great Northern will be a continuation east toward Spokane and possibly west to Everett and Seattle. Power for electric operation east of Wenatchee will be supplied from the extensive transmission system of the Washington Water Power Company in eastern Washington. For a number of years the Great Northern has owned a power site on the Chelan River, but under an agreement with the Washington Water Power Company this site is now being developed by the power company and additional energy will be available throughout eastern Washington from this plant.

The Northern Pacific is known to be making engineering studies on electrification plans and it is likely that an announcement of these plans will come in from three to five years. At the time of such electrification the Northern Pacific will find ample power available from the transmission systems of eastern and western Washington, and it is safe to predict that the railway company will find it advantageous to purchase power from these systems, as did the Great Northern, rather than undertake a separate power development.

Water Power and Hydro-Electric Development in Tasmania

BECAUSE of its mountainous character and the heavy precipitation Tasmania is favorably situated as regards water-power resources, and it has been estimated in that country that 500,000 hp. can be generated, according to a report to the Department of Commerce from Assistant Trade Commissioner Foster, Melbourne, Australia. The Hydro-Electric Department of the Tasmanian government controls three of the power undertakings—the Waddamana scheme, the Electrona Carbide Works and the small 1,500-hp. plant of the Launceston Corporation, which was the first hydro-electric plant to be constructed in Australia. Other schemes of importance are those of the Mount Lyell Mining & Railway Company and the Electrolytic Zinc Company.

The first large power scheme was begun in 1911, when the Hydro-Electric Power Company was formed to develop the water power of the Great Lake and River Ouse catchment areas. The first stage was the construction of the 10,000-hp. plant which supplied Hobart and suburbs, the surplus power being absorbed by the zinc industries. Waddamana is approximately in the center of the state, and a radius of 75 miles from the power station covers a large part of the island. It was decided to build four 88,000-volt transmission lines to Hobart and one to Launceston. The first installation was completed in May, 1916, and power rates were reduced considerably in order to encourage the establishment of large industries. The original Hydro-Electric Company, which sold the Waddamana-Great Lake undertaking to the Hydro-Electric Department, invested its capital in carbide works at Electrona, about 15 miles south of Hobart. These works were subsequently taken over by the government.

At this time the Amalgamated Zinc Company decided to establish works in Tasmania to treat zinc concentrates from Australia, the new company being known as the Electrolytic Zinc Company. The Hydro-Electric Department gave the company an option on 30,000 hp., the rates being fixed at £2 per horsepower-year. The company established a plant at Risdon, near Hobart, and now uses continuously 33,500 hp. from the Waddamana plant. A new schedule reduced the rate for lighting and industrial purposes and resulted in an increase of revenue in less than eight years from £18,000 to more than £100,000 a year.

The Mount Lyell Mining & Railway Company hydro-electric undertaking at Lake Margaret is the next in importance. It develops 10,000 hp. and sells its excess power to the Hydro-Electric Department, which transmits it over a 44,000-volt line to Zeehan, on the west coast.

The combination of adequate water power and short transmission distances has made it possible to quote low rates and thus attract large industries to the island. Three such industries are in operation in this region, and a wood pulp industry which will use considerable electrical energy is being established.

Characteristics of Induction Motors on A.C. Network

Curves Showing Changes in Characteristics When 220-Volt Motors Are Operated at Network Voltages—Heating Limitation Not So Serious as Decreased Starting and Breakdown Torque

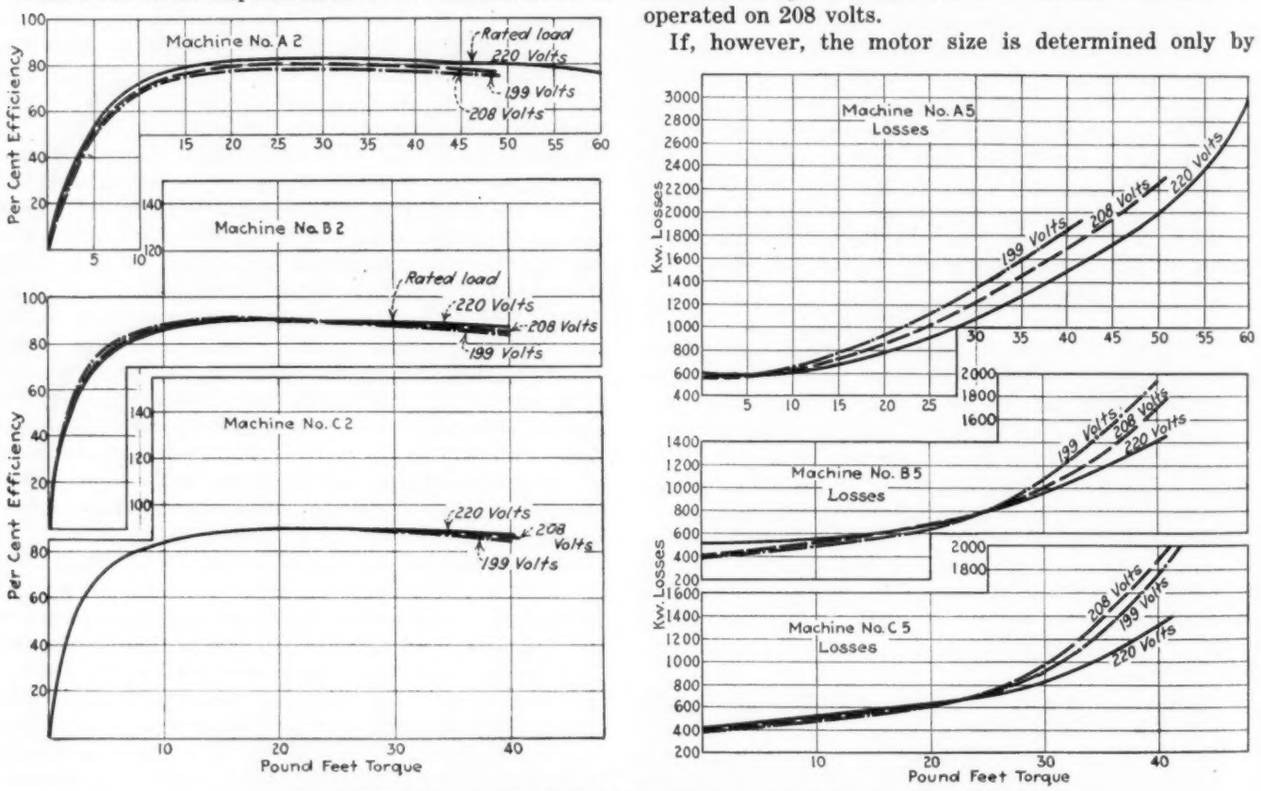
By RUSSELL G. WARNER
Assistant Professor of Electrical Engineering, Yale University

IN THE newer systems of four-wire, three-phase distribution it is customary to operate polyphase induction motors on lighting feeders at the nominal voltages of 199 or 208 volts, and since it is also customary to apply 220-volt motors, the question arises as to their operating characteristics.

There are three important limits to be considered in applying induction motors—namely, starting torque, overload or breakdown torque and heating. The first two of these limits depend on the voltage and vary practically with the square of the voltage. The heating depends on the total losses, of which the friction and windage are practically independent of the voltage, the iron losses varying almost with square of the voltage and the copper losses varying with the square of the current, which in turn increases less than the voltage decreases for a constant torque load. The heating for a constant load actually decreases with voltage if the load is small and increases somewhat with voltage if the load is near full load or more.

When 220-volt motors are to be applied on circuits supplied with 199 or 208 volts, larger motors than normal should be selected. If the size is dependent largely on starting or breakdown torque the 220-volt motor selected should have an output rating of 18 per cent greater than normal if it is to be operated on 199 volts and 10 per cent greater than normal if it is to be operated on 208 volts.

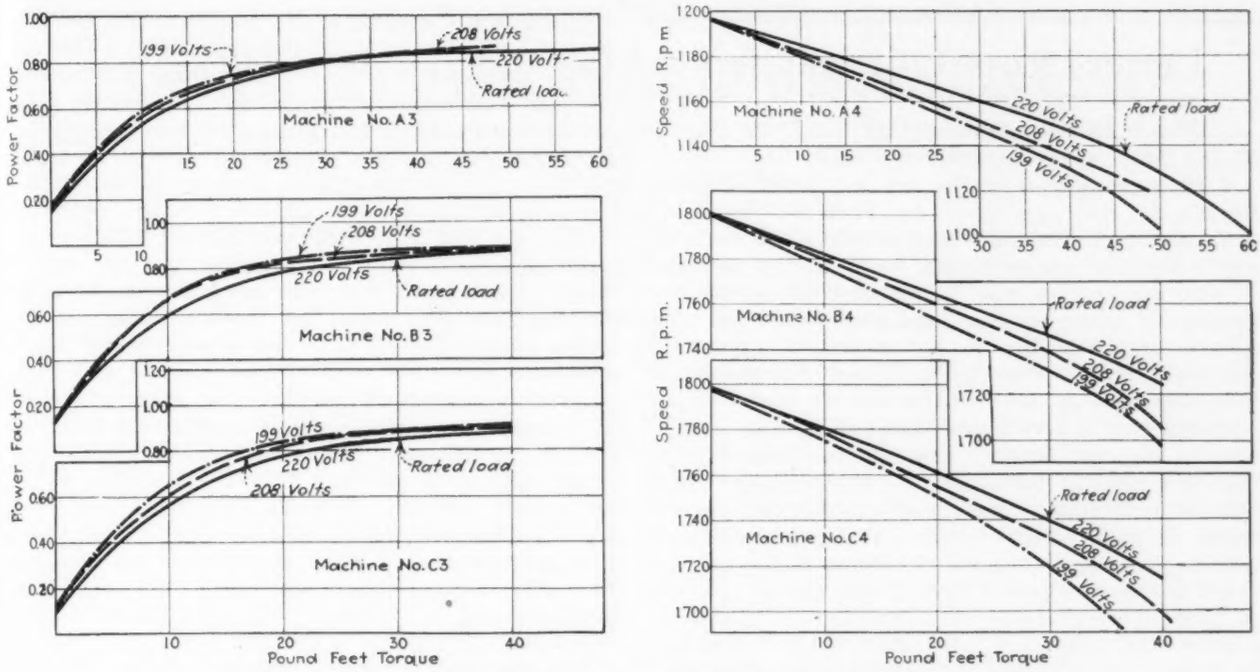
If, however, the motor size is determined only by permissible heating, the increase in size need be only that of the voltage decrease—namely, 10 per cent larger if motor is operated on 199 volts and 5 per cent larger if motor is operated on 208 volts.



LOWER VOLTAGES AFFECT EFFICIENCY AND LOSSES APPRECIABLY AT HEAVY LOAD
At left—Efficiencies of three motors for varying loads. At right—Motor losses at varying loads

DATA FOR THREE TEST MOTORS

Motor	A	B	C
Type	Wound motor	Squirrel cage	Squirrel cage
Syn. speed	1,200	1,800	1,800
Horsepower	10	10	10
Volts	220	220	220
Phases	3	3	3
Amperes (rated)	27.3	25	24.4
Temperature rise	....	....	....
Continuous load, deg.	40	40	40

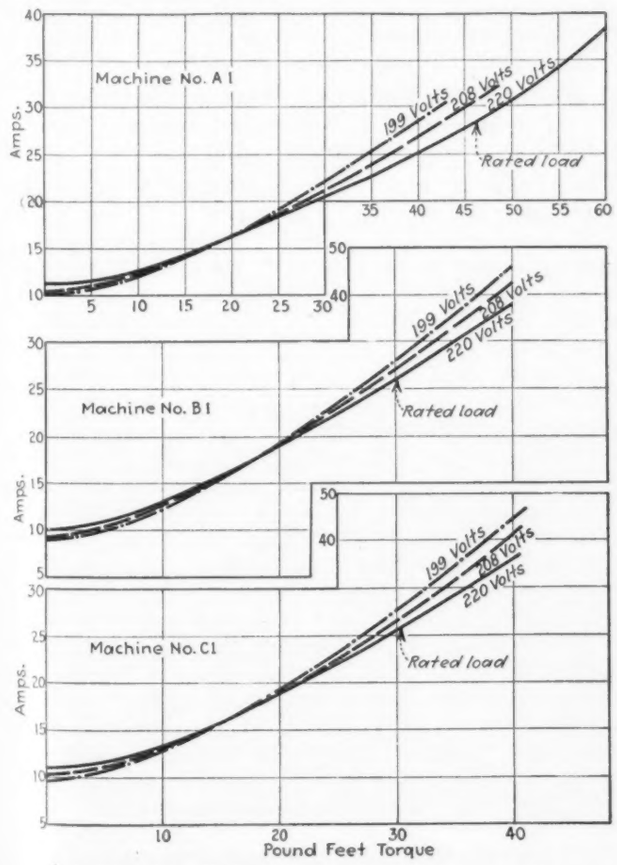


POWER FACTOR IS BETTER AT LOWER VOLTAGES BUT SPEED IS AFFECTED APPRECIABLY

At left—Power factors of test motors at varying loads. At right—Changes in speed of three motors at varying loads.

The characteristics of three motors, each of a different manufacturer, are shown for normal and reduced voltage in the accompanying curves. The data for these motors are given in the accompanying table.

It will be noticed that in general the power factor of the motor is higher with reduced voltages, hence the usual handicap of under-loaded motors is not as great with reduced voltage impressed. The speed reduction due to reduced voltage is practically nil up to full load. The efficiency change is also very small with reduced voltage.



CURVES OF AMPERES AND TORQUE IN POUND-FEET FOR MOTORS A, B AND C

An important consideration in the application of motors is the effect of line drop with load, resulting in reduced voltages at the motor terminals. On power circuits the permissible drop is greater than the permissible drop on lighting circuits. On these four-wire circuits for lighting as well as for motors, the circuit voltage will be more constant than for the usual power circuit. Hence the performance of motors on this type of circuit will be more nearly as indicated on the lower voltage curves, while on a power circuit of correct nominal voltage the performance may actually approach that of the reduced voltage due to line drop.

Another factor which may be of greater importance than the change in characteristics is the undervoltage protective device on the auto-starter. With a 10 per cent reduced voltage as normal the undervoltage relay will be sensitive to a small drop in line voltage.

In general, standard induction motors of a slightly larger size will give satisfactory performance on either the 208 or 199-volt, three-phase system.

Austrian Electrotechnical Industry in Stage of Readjustment

REPORTS to the Department of Commerce from Consul Robert W. Heingartner, Vienna, Austria, say that of the four largest electrical plants in Austria three are subsidiaries of prominent foreign concerns, the Oesterreichische Siemens-Schuckert Werke (German), the A. E. G. Union Elektrizitäts Gesellschaft (German) and the Oesterreichische Brown Boveri Werke (Swiss), while the fourth—the Elin Aktiengesellschaft für Electrische Industrie—is a purely Austrian concern.

Letters from Our Readers

Brush Friction and Contact Air Pressure

To the Editor of the ELECTRICAL WORLD:

I have recently read the article "Brush Friction Greatly Affected by Contact Air Pressure," by W. E. Stine, in the ELECTRICAL WORLD of July 10. Some years ago I was doing experimental work on the operation of slip-ring brushes and the selection of satisfactory grades for heavy currents, and during this work the air pressures under brushes were measured in a manner similar to that described by Mr. Stine. The results, in brief, were that the air condition between the brush and a smooth ring is very unstable and will change greatly without apparent cause. In commercial types of brush holders a touch of the finger or a slight change in the point of application of the spring pressure may be sufficient to modify the air pressure to a considerable extent. In these tests the air pressure at the toe of a brush was usually quite different from that at the heel. In general the pressure at the toe was found to be greater than atmospheric, whereas that at the heel may be either greater or less than atmospheric. Pressures as great as 1¼ lb. per square inch were measured under certain conditions.

As noted in the article, the slotting of the collector ring will destroy the air pressure almost completely. The advantage of this is to be seen when the brush contact drop is considered. A positive air pressure was found to have the tendency to separate the contact surfaces and thus increase the voltage drop, with the consequence that the brushes showing the greatest air pressure carried little current. In fact, it was found by measuring the current in individual brushes operating in parallel that it was possible to have up to 30 per cent of the brushes carrying no appreciable current. It was also found that when the current was carried by brushes under these conditions of poor contact, the rate of brush wear would be high, due probably to some electrical action of currents being carried across minute gaps. The use of slotted rings on these tests equalized the currents in the brushes and decreased the rates of wear greatly. It was indicated that current densities considerably higher than those ordinarily considered satisfactory could be used on rings that had been properly slotted with more consistent operation and less brush wear. There were, however, some difficulties in slotting rings for commercial use.

E. B. SHAND,
Power Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Making the Most Efficient Use of Hydro-Electric Units

To the Editor of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD of June 19, under the heading "Operating a Concentrated Power System," P. B. Juhnke makes a statement calling for the loading of the most efficient units to the exclusion of the less efficient ones. This is an excellent practice for interconnected systems composed of steam generating units, but will not hold true for efficient generation by a hydro-electric system when accumulation and maintenance of water in reservoirs to provide an ample amount of energy for the winter months is considered.

The Western Colorado Power Company, operating in southwestern Colorado, is the hydro-electric system I shall use for illustration of this proposition. This system is composed of five hydro and three steam plants of small capacity, the total rating of the system being approximately 16,000 kva. The system load is carried by the hydro-electric plants continuously, the steam plants remaining idle except at such times as a transmission line has failed and the local consumers are depending on the output of the steam plant in their district.

The storage of water is accomplished by two natural lakes. The larger one, Electra Lake, supplies the Tacoma plant with water, and Trout Lake supplies the Ames plant. Electra Lake has a capacity of 23,576 acre-feet, containing 117.88 day-second-feet and Trout Lake has a capacity of 2,490 acre-feet, containing 1,245 day-second-feet. Although the run-off at the two lakes is virtually the same, Trout Lake will regain its maximum capacity sooner than Electra Lake owing to the much smaller amount of storage it provides. After this point has been reached at Trout Lake any water flowing into the reservoir must be wasted over the spillway, while Electra Lake is only partly filled. To eliminate so great a waste will necessitate an increase of load at Ames and a decrease of load at Tacoma.

This manner of utilizing all the wasted water at Trout Lake and decreasing the load at Tacoma, also the day-second-feet flow through the Tacoma flume, permits the Electra Lake reservoir to be refilled quickly with the least amount of wasted water. It lowers somewhat the operating efficiency at Tacoma, but this must be sacrificed in the endeavor to refill the exhausted reservoirs for another period of operation when there is a very small amount of water flowing in the streams.

H. W. FORMAN, JR.
Chief Load Dispatcher.
Western Colorado Power Company,
Silverton, Col.

Westinghouse Engineers' Work in the Study of Arcs with Stereoscopic Camera

To the Editor of the ELECTRICAL WORLD:

In the July 17 issue of the ELECTRICAL WORLD, page 130, under the heading "Suggestions for Research," there appeared an item entitled "Photographic Study of Arcs with Stereoscopic Camera." We should like to call to your attention the work of Westinghouse engineers on this particular subject. A considerable amount of investigation has been undertaken, commencing in 1919, using a high-speed stereoscopic camera capable of taking photographs at the rate of 3,000 per second. This was developed by a Westinghouse engineer, J. W. Legg.

The subjects investigated have included those listed in the ELECTRICAL WORLD and others. For example, high-voltage and low-voltage arcs, air-switch operation, commutation, commutator flashover, insulator flashover and welding arcs have been photographed. Papers which have been published including work on stereoscopic photographing of arcs are as follows: (1) "Polar, Multi-Exposure, High-Speed Camera," by J. W. Legg, *Electric Journal*, 1919; (2) "A Suspension Insulator for High-Voltage Systems," by D. F. Miner, *Electric Journal*, 1924; (3) "The Development of a Suspension-Type Insulator," by H. B. Smith, *Journal of A.I.E.E.*, August, 1924; (4) "Photography of Arcs," by H. W. Tenney, *Electric Journal*, May. 1926.

R. S. FEICHT,
Director of Engineering.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Central Station and Industrial Practice

Power Supply to United Verde Copper Mine

BY E. W. FREDELL
Chief Electrician United Verde Copper Company, Jerome, Ariz.

POWER for the mine of the United Verde Copper Company at Jerome, Ariz., is supplied from a substation, located 3,100 ft. from the collars of the main shaft, over three 2,300-volt feeder cables carried for a part of the distance through the main audit and through a power tunnel for the remainder. At the shaft collar on the 500-ft. level is located an underground substation and hoisting station where switching facilities have been provided so that the load may be shifted to any one of the feeders in an emergency.

Normally the three feeders from the main substation are used, one for motor-generator sets, one for the man hoist and the third for general mine use. Down the shaft two three-phase, 2,300-volt cables are carried in vertical concrete ducts. One cable is for lighting and is sectionalized every 150 ft. and taps are taken off for a lighting transformer. The other cable is used for pumping, ventilation and hoisting service and is sectionalized at all points where large blocks of power are taken off—that is, at the 1,000-ft., 1,950-ft. and 2,400-ft. levels. Cables for signal, telephone and trolley service also are carried down into the mine in concrete ducts. These are sectionalized at each level (approximately every 150 ft.) and brought out to a rack as shown in Fig. 1 for use on the level. The general arrangement of power supply to the mine is shown in Fig. 3. Standard three-conductor, armored submarine cable is used for installations underground with suspensions every 150 ft. in vertical runs. To date no cable has shown

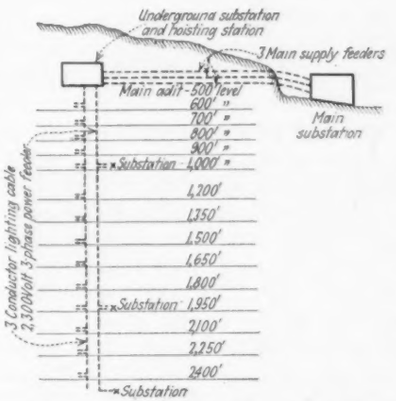


FIG. 3—GENERAL SCHEME OF POWER DISTRIBUTION IN THE UNITED VERDE MINE

any sign of deterioration from this length of suspension.

Distribution boxes and other equipment on one of the levels is shown in Fig. 1. A lamp that burns continuously has been placed in all steel cabinets as shown in Fig. 2 to prevent dampness from condensation and consequent danger of grounds and other troubles.

A red bull's-eye which is located in the steel cabinet cover opposite the lamp shows at a glance from the outside whether the lamp is burning and the box is energized.

Conjectures and Speculations

ELECTRICAL INSULATION

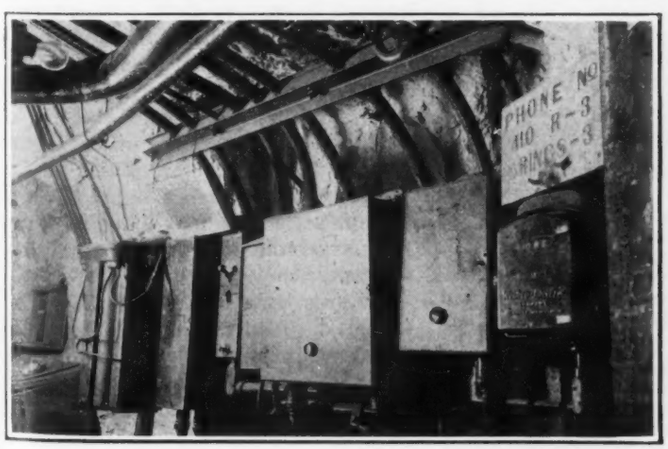
BY C. L. KASSON
Edison Electric Illuminating Company of Boston

FROM the practical standpoint we all realize that the insulating material that is most homogeneous and has the least number and size of voids, together with the lowest moisture content, will show the greatest dielectric strength under an electric stress.

From the scientific standpoint we know that the air or gas within the voids is ionized (so called) if the electric stress is great enough. As a result of this ionization chemical action may take place, and this perhaps deteriorates the material. We are well aware that a very small moisture content is very detrimental. A good insulating material must then have the minimum of moisture, and this can be secured by proper treatment.

Almost all insulating materials are porous to some degree and the voids must contain air at or near atmospheric pressure. When this air in the voids is under stress, perhaps there is action at stresses below the so-called ionization point. This may be one of the causes of electrical aging of insulating material.

If the air is under a direct-current stress, perhaps the results are different from those when under an alternating-current stress. With direct-current stress there is possi-



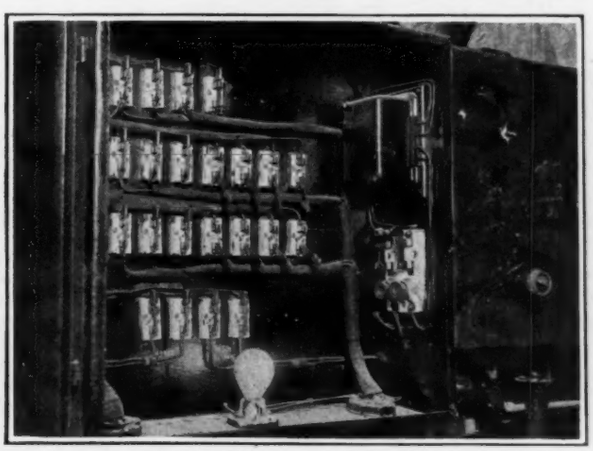


FIG. 1 (AT LEFT)—TYPICAL DISTRIBUTION CENTER ON ONE OF THE LEVELS OF THE UNITED VERDE COPPER MINE. FIG. 2 (AT RIGHT)—CONTINUOUS BURNING LAMP PREVENTS CONDENSATION IN MINE DISTRIBUTION CABINETS
The particular view in Fig. 2 shows the interior of a signal cabinet

bility of chemical action in the air, due to unidirectional current flow. Also the material itself may be subjected to chemical action by a direct-current stress. Furthermore, there may be reactions between the entrapped gas and the material.

Now, if air conducts at all stresses, then total action is a function, perhaps, of time. In other words, is it not likely that action may take place at lower stresses than those which ordinarily produce the so-called ionization and that over a long-time period the action would be of considerable magnitude?

Ionization action may be in the nature of an accelerated test. If the stress is high enough, we know that detrimental action is taking place in insulating material. However, perhaps the same action is going on in less degree at lower stresses. The results are then a question of time.

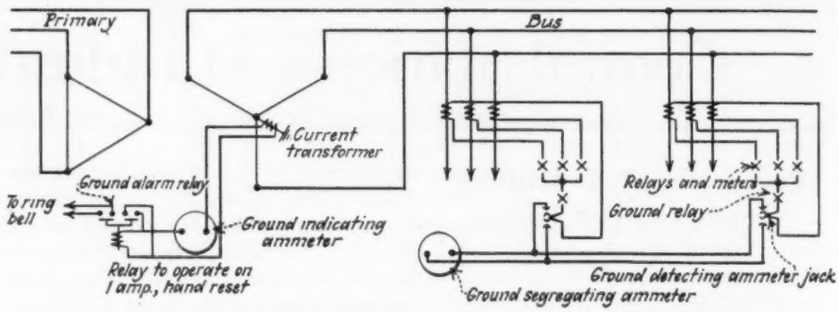
Testing Polyphase Meters on Single Phase

POLYPHASE meters belonging to the Northern States Power Company are tested on single-phase energy with single-phase meters and loads. First the upper element is tested on full load, then the lower element. Finally the upper and lower elements are tested separately on light load.

The advantages of this method are partial standardization of equipment for both single-phase and polyphase meter testing, simplification of connections and reduced weight of equipment.

Cost of Enlarging an Outdoor Substation

THREE 200-kva. transformers and two 100-amp. regulators were recently added to an outdoor substation of a Massachusetts central station in a small town about 60 miles from Boston. The total cost of this work, including wiring and equipment, was $12,186.89, and the major items were: Labor, $1,340.60; liability insurance, $24.03; automobile and truck mileage, $573.12; materials and apparatus, $9,051.45; miscellaneous, $89.87; engineering and construction charge, $1,107.82. In the equipment schedule were the three transformers, rated voltage 13,200/2,300/4,600, $2,988.15; the two regulators, 4,600/200/100 volts, $3,728; and twenty-one lightning arresters, $213.80.



SCHEME FOR DETECTING LIGHT GROUNDS ON A GROUNDED SYSTEM

Detecting Light Ground Currents

BY R. C. CRIPPIN
Relay Engineer Carolina Power & Light Company, Raleigh, N. C.

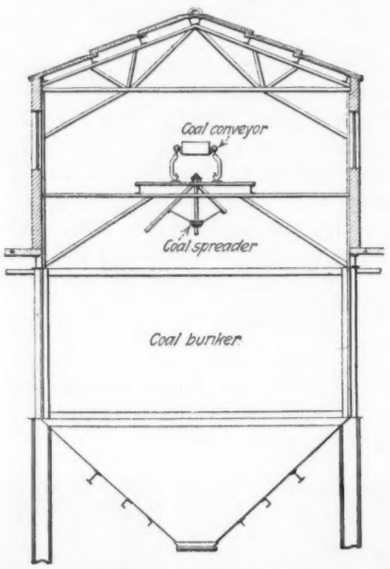
ON SYSTEMS operating with a grounded neutral and using ground relays it is often necessary to set the ground relays at the principal substations much heavier than would be desirable if it were not for the fact that successive operation must be obtained with other relays. Cases of high-resistance grounds may take current too light to operate these relays. It is then desirable to have some way of detecting these ground currents when they occur.

A scheme that is being installed by the Carolina Power & Light Company in some of its important stations to detect these currents is shown in the accompanying illustration. The current transformer that operates the ground alarm relay may be installed in the ground lead of the transformer bank that grounds the system; or it may be installed in series with the delta winding of the bank so that it measures the current that circulates around the delta due to ground current flowing from the bank; or, if the transformer bank should have three current transformers connected in Y on its secondary side, the ground alarm may be connected in series with the residual lead from these current transformers. The choice as to the location of the alarm relay depends on the connections of the transformer bank, its voltage and existing equipment. The size of the current transformer depends upon conditions. One having a rating equal to the full load current value of one leg of the grounding bank has been chosen in some cases.

The ground alarm relay should operate on a very light current, say 1 amp., through it. Since it will often get more than 1 amp., it should short circuit itself when the plunger rises, at the same time ringing a bell or operating some other alarm device. The ammeter, which is in series with the relay, may have a 5-amp. scale. It may be either an ordinary indicating meter or may be a graphic meter.

After a light ground has been detected the feeder having the ground on it can be located by means of the ground-detecting ammeter jacks shown at the right-hand side of the illustration. These jacks are in the residual leads of the current transformers that operate the relays on the different circuits, and when the

Bunker Coal Spreader



TO SECURE a more uniform distribution of coal discharged from conveyors into storage bunkers the Iowa Railway & Light Company has developed a new spreading device, which is mounted at the top of the bunker and below the discharge point of the conveyor. This device consists of two steel plate chutes of an inverted V-shape mounted on a vertical shaft which is rotated either by hand or by motor at a suitable speed. The chutes are placed at an angle of 45 deg. from the vertical and made with one leg long and the other short. The distributor, being located immediately under the falling stream of coal from the conveyor, evenly spreads the fuel to all parts of the bunker.

plug is placed in a particular jack, the residual lead of that set of current transformers is connected through the ground-segregating ammeter, which indicates whether or not that circuit is the one having the ground current on it.

Working with Safety

BY J. E. JORDAN
Distribution Superintendent El Paso Electric Company, El Paso, Tex.

CONTRARY to the average interpretation, "Safety First," or preferably "Safe Working," is not an intangible, meaningless, over-worked state of mind. If properly conceived, it can become a most tangible factor from an efficiency as well as a humanitarian point of view in any operating company.

Late in 1923 the distribution department of the El Paso Electric Company launched a safety movement that has enjoyed signal success. Previously to that time the characteristic attitude of the average employee toward an accident was that of a fatalist—it simply happened. Positive and continued effort has been made to impress the fact that an accident never "just happens." The cause may be obscure, but if a careful analysis is made, the accident can usually be traced to someone's disregard of rules of safety. It might be an "I'll take a chance anyway" lineman or a foreman who had neglected properly to instruct his men on the dangerous nature of some phase of the work.

Periodic mass meetings are called of the entire department personnel. Here safety, or safe working, is instilled in the men in a commonsense, tangible manner. Frequently at these meetings an official of the company comes before the men with a personal appeal. The effect of the appeal coming from one higher up is to counteract the average tendency to minimize the importance of such efforts.

Each foreman is held responsible for the condition of all tools, rubber gloves, blankets, etc., among his crews. All new equipment of this character is given a high-voltage puncture test before being issued. A recent purchase of a complete set of hot-wire tools not only insures maximum safety but is a great asset to service continuity.

A first-aid team organized during 1925 has proved a valuable asset. The team, consisting of seven picked men thoroughly trained by their captain, a man with previous experience in such work, frequently gives public demonstrations of first-aid practices, with special attention to artificial resuscitation. The effect of this has been that in case of drowning or similar accidents the "Electric Company Team" is invariably summoned. The schools are visited each year and the children warned against kite flying and wire throwing, and the danger not only to them but to the service rendered by the company is explained. The public is made familiar with the safety work through various mediums such as newspapers and the "Safety Exhibit" shown in the accompanying illustration. This exhibit was displayed in one of the salesroom show windows.

SAFETY EXHIBIT OF THE DISTRIBUTION DEPARTMENT OF THE EL PASO ELECTRIC COMPANY

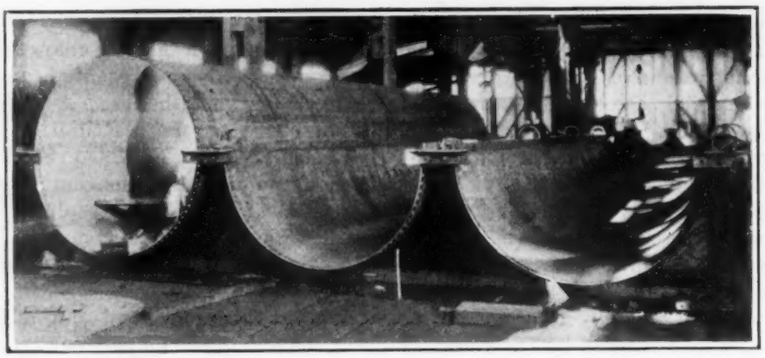
Every service car carries a small dash card calculated to keep certain safety suggestions before the drivers. Where service cars and trucks enter a main thoroughfare is placed a sign reading "Company Cars—Full Stop —El Paso Electric Company."

The interest aroused among the men developed a spirit of rivalry between two departments that brought a challenge to a safety contest evoking considerable enthusiasm and effort. The contest ended with a banquet by the loser. Safety contests have proved a great incentive toward accident prevention. During 1924 a 107-day no-chargeable accident record earned for the department a safety banquet as a reward. In an effort to establish another record from July 31 to Nov. 28 a period of 119 consecutive days was completed without a single chargeable accident. This represented more than 95,000 man-hours. A safety contest between the distribution department of the El Paso Electric Company and that of the central station at Beaumont, Tex., resulted in a victory for the El Paso company. A $150 banquet fund was the penalty for the loser.

Whereas the accident curve has been dropping, the employment curve has been steadily rising. The significant factor in this continued improvement is the accidents per man relation. This dropped from a one accident per man height in 1923 to 0.07 accident per man in 1925, or from 56 accidents among 56 men in 1923 to seven accidents among 95 men in 1925. In summing up it might be stated that the achievements outlined here, it is believed, are a direct result of concentrated effort and that the ultimate goal of the department might be characterized "Service with Safety."

Transmission Line Hazards

SCARCELY to be classed with pheasants, squirrels, snakes, eagles, buzzards, cranes and other peculiar causes of transmission line failure in the West, but withal a somewhat unusual cause of such failure and worthy to be put in the category of rare transmission hazards, is baled hay. The other day in the vicinity of Portland one of those



CROSS-SECTION OF PIPE PREPARATORY TO WELDING, ALSO COMPLETED LENGTH

midsummer atmospheric phenomena known as whirlwinds or twisters, which in the Northwest occasionally take on the aspects of a miniature tornado, picked up a bale of hay from a farmyard and tossed it 50 ft. in the air and into a 57,000-volt line of the Portland Electric Power Company.

Switches at both ends of the line relayed out, and on being again thrown in repeated the operation. Almost at once operators were advised by an observer of a fire burning on the transmission line near one of the poles, and investigators found a portion of a bale of hay, still burning, resting squarely across two phases. Broken insulators on the pole nearest to the place where the bale had come to rest gave evidence of a severe shock. Wisps of hay, burning loose, had fallen, still in flames, to the ground beneath the line, where they had started a grass fire.

Welded Pipe Line Progress at Oakland, Cal.

BY JOHN B. ABELL

MORE than five miles of welded steel pipe has already been laid in the trenches to form part of the water supply line for the city of Oakland, Cal. Accurate costs being kept on the fabrication of the welded pipe already manufactured provide ample evidence of the economies possible through the use of the new process. Known costs, it is said, on work already done provide complete justification for the $3,000,000 saving that has been guaranteed by the company on the fabrication of the 90 miles of pipe, as against the estimate for supplying either lock-bar or riveted pipe.

The tremendous savings result from reduced labor costs and a substantial decrease in the amount of steel required for the pipe. Due to the fact that it has been found possible with the Stable-Arc to provide practically 100 per cent connections and joints and thus to have a strength equal to the steel itself, the quantity of steel involved in the pipe has been materially reduced as against that which would have been required for other methods of construction, where extra-heavy steel plate is necessary to compensate for the weakness of the connections.

Of vital importance is the fact that the welded pipe is being put through tests beyond those which could be withstood by pipe employing any other known joining method. Subjected to these tests, each 30-ft. length has come through thus far without failure or damage. In the case of the ½-in. pipe the 30-ft. sections are carried up to a pressure of 312 lb. per square inch, which gives about 21,500 lb. fiber stress in the steel. While under this pressure, each pipe section is sledged on every foot of the weld with a 19-lb. hammer. Following this procedure, the pressure is increased to 400-lb. per square inch, which represents the elastic limit of the steel itself.

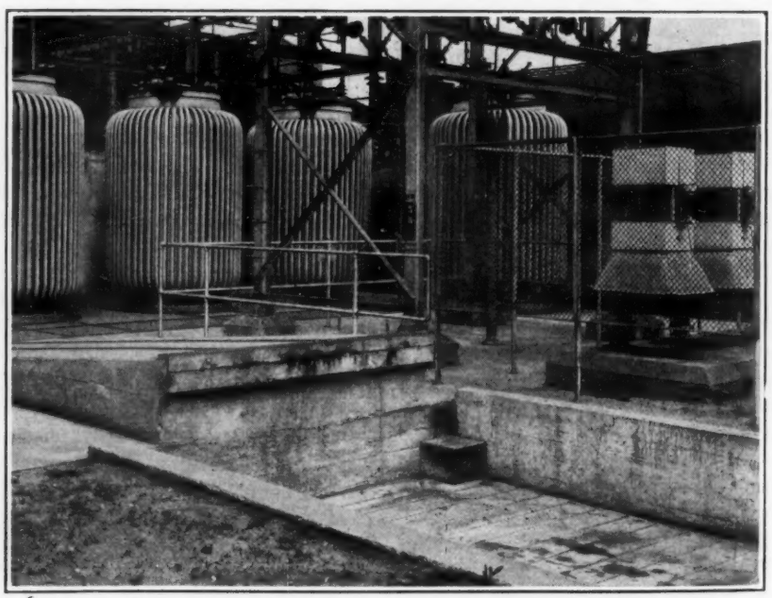
Only after having successfully passed this test without developing any leaks is the welded pipe passed through for final treatment. The sections, after having been thus tested, are dipped in bitumastic, then wrapped with a protective covering and put in the trenches.

Among other severe tests to which sections of the welded steel pipe for the Oakland job have been subjected was one which consisted of collapsing the pipe under pressure.

Ramp Facilitates Loading and Unloading

WHEN outdoor substation capacity has to be increased, equipment therein substituted or apparatus overhauled at some more convenient point, transformers, oil-circuit breakers and other heavy apparatus have to be loaded onto or unloaded from transportation equipment. Providing a permanent structural framework from which blocks and tackles can be supported may be expensive and may consume considerable time.

At the university substation of the Northern States Power Company, Minneapolis, a concrete ramp has been constructed at the street entrance to the substation so that a truck can back up and load or unload directly. Cast in the top of the ramp are rails that extend between both bays of the substation with cross-tracks.



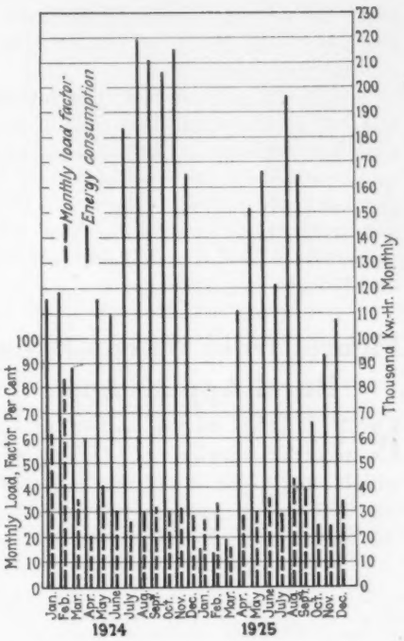
CONCRETE RAMP FOR LOADING AND UNLOADING EQUIPMENT

Commercial Activities and Public Relations

Open-Pit Stripping and Mining by Electricity

EIGHT to ten electric shovels and two electric locomotives are being operated from purchased power in the Mesaba Iron Range district, which is served by the Minnesota Power & Light Company, Duluth. They are used in stripping and conveying overburden and iron ore from the open-pit mines of that district. Prospects of more similar applications are in sight, inasmuch as 60 per cent of the iron ore mined in the United States comes from this district and considerable of it from open-pit mines. Replacement of other methods by electrical methods and purchased power is obstructed chiefly by the mine operators' investments in existing equipment and the tax on industries in the state, not by the lack of mine operators' desire to use the equipment. Already the mines are electrified from the utilities' lines to the extent of 58,500,000 kw.-hr. a year (1925).

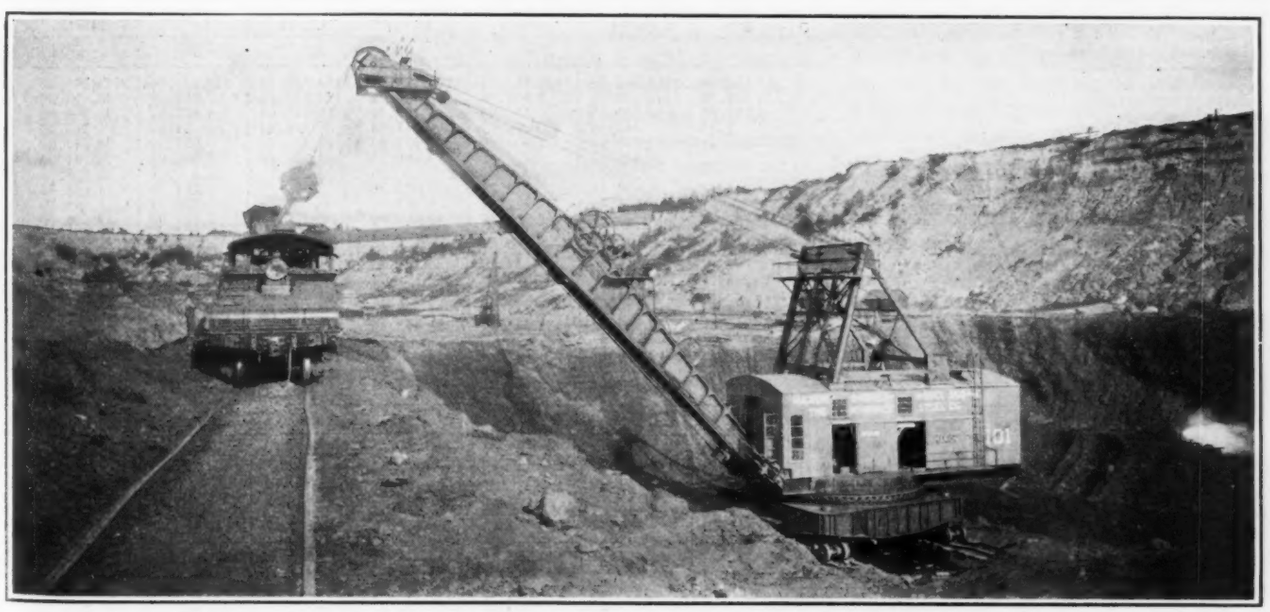
One of the open-pit mines near Buhl, Minn., is totally electrified, using purchased power for two 60-ton locomotives, two electric shovels and various shop applications. One of the shovels is a No. 350 Marion with a 90-ft. boom and having a 100,000-lb. bale pull. The locomotives are capable of pulling a train of stripping cars up a 5 per cent grade, whereas the steam locomotives ordinarily used could pull the same load only up a 2 per cent grade. Maintenance and repair of this electrical equipment, as well as the labor, are much less than with equivalent steam equipment.



MONTHLY ENERGY CONSUMPTIONS AND LOAD FACTORS OF A TOTALLY ELECTRIFIED OPEN-PIT IRON MINE HAVING TWO ELECTRIC SHOVELS AND TWO LOCOMOTIVES

During 1925 the energy consumption of this mine was 1,228,436 kw.-hr.; the year preceding it was 1,806,758 kw.-hr. The peak loads in these two years were 685 and 1,008 kw. respectively, giving yearly load factors of 20.5 and 20.4 respectively. Considering the duties of the equipment, very high monthly load factors are obtained, reaching as high as 84 per cent in February, 1924, when the overburden was being stripped and the haulage duty was not so great. A load factor of 39 per cent was attained in September, 1925, when the mine was in full swing. The maximum consumption during 1924 occurred in November and amounted to 215,200-kw.-hr.; the maximum in 1925 was 196,080 kw.-hr. and occurred in August. The minimum consumption occurred in April, 1924, and February, 1925. The yearly load factor is low, due to the fact that open-pit mining cannot be continued during some of the winter months and also because of the limited navigation season on which shipping of ore chiefly depends.

The shovels are supplied with power through trailing armored 2,300-volt cable feeding a 2,300-volt motor-generator set. Ward-Leonard control is employed for the motors.



ONE OF THE OPEN-PIT IRON MINES ON THE MESABA IRON RANGE SERVED BY THE MINNESOTA POWER & LIGHT COMPANY

The locomotives are equipped with pantograph and side-arm contacts, as well as trailer cables used for fixed track, extension track and emergency feed supply respectively. The side-arm contacts permit supporting the trolley wire from portable poles at one side of temporary track extensions.

W. S. Heald is general sales manager of the Minnesota Power & Light Company.

Operating Expenses for Street Lights

DATA just made available for the year 1925, by the Department of Gas and Electricity of Chicago, show the accompanying expenses for the municipal street-lighting system. The equipment involved is shown in the smaller table. The complete costs per lamp are based on estimated additional charges that would exist if the city accounting were on the same basis as a private business.

It may be observed that the total unit expenses average $43 per lamp per year and range from $94.34 for 1,000-cp., 20-amp. lamps to $30.67 for 100-cp., 4-amp. lamps. The unit costs for underground systems average about 35 per cent higher than for overhead systems.

Nearly 28 per cent of the lamps are 100-cp., .6-amp. type; 22.3 per cent are 600-cp., 20-amp.; 19.5 per cent are 250-cp., 6.6-amp., and 16.3 per cent are 600-cp., 10-amp. The average total unit costs on these are respectively $31.37, $51.53, $45.02 and $57.96.

Figures from Wisconsin on Rural Applications

REFERRING to the cost of using electric service on the farm, which up to this time has been the big bugbear of rural electrification, the report of E. R. Meacham and W. C. Krueger, project leaders of the Wisconsin farm-electric experiment line, to the Wisconsin Committee on the Relation of Electricity to Agriculture, says:

"If a farmer will use five times as much electricity—and he can profitably—as the city dweller, he should be able to buy current at about the same rate per kilowatt-hour as the city customer of an electric company.

"Electrical operation of a small feed grinder may in itself save the average farmer enough cash outlay to pay this total bill for electricity during the grinding season of six months. On three farms 6,900 lb. of feed was ground in one month at a cost of 63 cents. The cost to have it ground at local mills would have been about $8.62. This comparative cost does not take into consideration doing away with the bother of bagging up the grain and hauling it to town and back.

"Experiments with hay hoisting show that when a motor replaces horses in lifting hay from a wagon

NATURE OF CHICAGO'S STREET-LIGHTING EQUIPMENT

Size of Type "C" Mazda Series Burning Incandescent Lamps	Dec. 31, 1924			Dec. 31, 1925			Increase		
	Aërial	Underground	Total	Aërial	Underground	Total	Aërial	Underground	Total
1,000 cp., 20 amp.	.....	154	154	519	285	804	519	131	650
600 cp., 20 amp.	13,534	2,575	16,109	13,437	2,380	15,817	*97	*195	*292
600 cp., 10 amp.	10,245	1,648	11,893	10,009	1,520	11,529	*236	*128	*364
400 cp., 15 amp.	338	.....	338	338	.....	338	.....	.....	.....
250 cp., 6.6 amp.	15	1,844	1,859	15	13,839	13,854	.....	11,995	11,995
100 cp., 4 amp.	.....	8,700	8,700	.....	8,706	8,706	.....	6	6
100 cp., 6.6 amp.	.....	19,507	19,507	.....	19,808	19,808	.....	301	301
Total	24,132	34,428	58,560	24,318	46,538	70,856	186	12,110	12,296

*Decrease

ANALYSIS OF STREET-LIGHTING EXPENSES

	1,000 Cp. Lamps, 20 Amp.	600 Cp., 20 Amp.			600 Cp., 10 Amp.			400 Cp., 15 Amp.
		Aërial System	Underground	Total	Aërial System	Underground	Total	
Average number of lamps	235	13,514	2,403	15,917	10,193	1,655	11,848	338
Operation and Maintenance:								
Electrical energy	$4,604.54	$161,762.39	$28,763.91	$190,526.30	$151,423.20	$24,586.06	$176,009.26	$2,673.16
Substation expense	1,527.40	44,230.38	7,859.88	52,090.26	39,827.10	7,066.19	46,893.29	1,029.87
Incandescent lamps	2,500.00	34,761.63	6,340.53	41,102.16	28,413.49	4,877.37	33,290.86	1,650.32
Outer globes	2.83	440.36	76.85	517.21	311.44	51.58	363.02	.....
Labor of renewals, cleaning and patrolling	591.41	42,133.98	7,537.29	49,671.27	29,585.92	5,057.30	34,643.22	856.55
Lamp fixture repairs	.....	20,956.87	3,723.66	24,680.53	17,175.76	3,006.08	20,181.84	17.44
Manhole transformers	.....	.....	.....	.....	.....	.....	.....	.....
Eight-conductor lead-covered cable in conduit	42.12	1,690.58	312.72	2,003.30	1,553.35	284.36	1,837.71	34.79
Four-conductor lead-covered cable in conduit	26.97	998.46	172.91	1,171.37	907.25	158.14	1,065.39	21.01
Single-conductor lead-covered cable in conduit	222.47	.....	8,664.40	8,664.40	.....	7,806.00	7,806.00	158.68
5,000-volt steel-taped cable	.....	.....	.....	.....	.....	.....	.....	.....
600-volt lead-covered jute-covered cable	.....	.....	.....	.....	.....	.....	.....	.....
Underground conduit system	197.87	6,553.04	1,163.27	7,716.31	5,908.79	1,050.98	6,959.77	140.68
Lamppost maintenance, underground system	.....	.....	5,792.71	5,792.71	.....	3,891.74	3,891.74	.....
Aërial maintenance	.....	108,343.47	.....	108,343.47	81,654.77	.....	81,654.77	2,687.25
Automobile expense	173.81	12,382.91	2,215.15	14,598.06	8,695.12	1,486.30	10,181.42	151.82
Overhead expense	546.04	22,752.02	3,640.32	26,392.34	20,931.86	2,730.25	23,662.11	455.04
Total	$10,435.46	$457,006.09	$76,263.60	$533,269.69	$386,388.05	$62,052.35	$448,440.40	$9,876.61
Cost per lamp	44.40	33.81	31.73	33.50	37.90	37.49	37.85	29.22
Estimated Additional Charges:								
Ground rent	46.59	1,318.50	232.94	1,551.44	1,188.04	209.65	1,397.69	32.61
Office rent	30.00	1,275.00	200.00	1,475.00	1,150.00	150.00	1,300.00	20.00
Taxes	3,628.22	63,375.08	24,941.54	88,316.62	53,923.47	19,322.89	73,246.36	1,263.59
Depreciation	4,448.99	77,699.45	30,583.79	108,283.24	66,122.02	23,694.14	89,816.16	1,549.44
Interest	3,574.72	62,430.81	24,573.81	87,004.62	53,128.44	19,038.00	72,166.44	1,244.96
Legal and other service	9.00	382.50	60.00	442.50	345.00	45.00	390.00	6.00
Total	$11,737.52	$206,481.34	$80,592.08	$287,073.42	$175,856.97	$62,459.68	$238,316.65	$4,116.60
Charges per lamp	49.94	15.28	33.54	18.03	17.25	37.74	20.11	12.18
Complete cost per lamp	94.34	49.09	65.27	51.53	55.15	75.23	57.96	41.40

into a mow a saving of from 30 to 50 per cent in time is effected; also a smaller crew is required.

"Data on grinding bone for poultry show that by using a motor instead of buying bone meal a farmer can save $2.68 per 100 lb. Spare time grinding of bone for neighbors for $1 per 100 lb. can provide a farmer a profitable winter income.

"Figures on milking by motor show a saving averaging from 8 to 18 cents per 100 lb. over hand milking and from three to five minutes per cow.

"Testing with cream separators shows that it costs about 0.1 per cent per 100 lb. of milk separated.

"Cooking experiments show that the approximate cost for a family of six per month would be $7.14 with soft coal, $4.13 with kerosene, $3.46 with gasoline and $6.15 with electricity.

"Comparative figures in operating a water system disclose a cost of 3.85 cents per 1,000 gal. pumped with electricity and 14.8 cents pumped with gas and oil.

"Ironing tests show that to iron the same wash with a 5-lb. electric iron requires 2.18 hours, whereas with sadirons it takes 3.25 hours, a saving of 32 per cent in time and a saving of 36 trips to the stove.

"Floor-scrubbing tests disclose that about 400 sq.ft. can be scrubbed for 3 cents worth of current. This most disagreeable household task is accomplished in less time by electricity, the work is done better and at a fraction of the effort required by hand.

"Radio battery charging costs about 30 cents a month, saves the trouble of taking out the batteries and taking them to town for recharging.

"Electric heating experiments indicate that it is good practice in certain cases and for auxiliary heating, but is a waste of energy and prohibitive in cost when used for general heating."

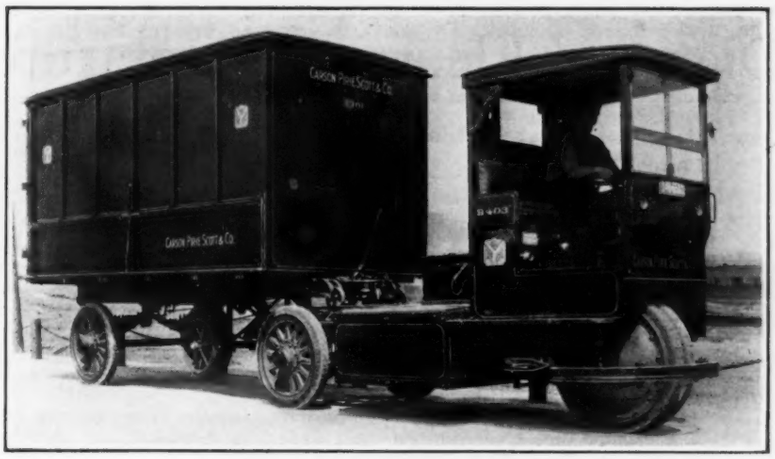
IN CHICAGO

250 Cp., 6.6 Amp.	100 Cp., 6.6 Amp.	100 Cp., 4 Amp.	Total
6,789	19,581	8,706	63,414
$37,004.29	$50,225.27	$23,261.34	$484,304.16
22,992.35	22,028.06	9,566.75	156,127.98
7,585.93	20,803.51	8,325.75	115,258.53
5,484.11	14,555.06	8,034.93	28,957.16
85,698.33	120,733.71	52,694.83	344,889.32
8,052.75	11,464.68	10,719.11	75,116.35
10,752.58	26,492.98	.....	37,245.56
775.79	858.79	438.14	5,990.56
470.92	495.65	246.58	3,497.89
3,605.43	3,739.76	1,708.29	25,905.03
708.13	2,082.82	2,772.50	5,563.45
3,515.95	33,972.26	.....	37,488.21
3,153.86	3,253.03	1,488.74	22,910.26
4,006.63	30,405.66	30,886.11	74,982.85
.....	.....	.....	192,685.49
25,188.42	35,485.87	15,486.67	101,266.07
10,920.97	20,476.82	8,554.76	91,008.08
$229,916.44	$397,073.85	$174,184.50	$1,803,196.95
33.86	20.27	20.00	28.43
684.87	652.26	293.53	4,658.99
625.00	1,100.00	450.00	5,000.00
23,125.37	67,063.49	28,652.40	285,296.05
28,356.78	82,234.56	35,134.13	349,823.30
22,784.42	66,074.73	28,229.96	281,079.85
187.50	330.00	135.00	1,500.00
$75,763.94	$217,455.04	$92,895.02	$927,358.19
11.16	11.10	10.67	14.62
45.02	31.37	30.67	43.05

Demonstrating Ranges in Small Communities

IN THE smaller towns served by the Northern States Power Company where there is a community spirit very effective results have been obtained in developing a range-buying desire by combination entertainments and demonstrations conducted by young lady representatives of the company. They arrange for the use of some hall, frequently securing it at no charge whatever because of the friendly relations which this company, through all its representatives, has developed. Some entertainment or vaudeville sketch is presented in which the use of the electric range figures. The guests are served with food prepared on the ranges. Following this a dance is usually afforded, the lady demonstrators providing the music.

During the lunch and subsequent dancing an opportunity is afforded the demonstrators to ascertain the most likely range prospects; these are then followed up by business calls another day. These methods have proved to be very effective in securing range sales.



ELECTRIC TRACTOR-TRAILER COMBINATION

Electric Tractor for Inter-Warehouse Hauling

BY R. MACRAE
Contract Department, Commonwealth Edison Company

THE electric tractor illustrated and three semi-trailers have displaced three horse-drawn trucks, eight horses and two out of three drivers formerly employed for the same work by Carson, Pirie, Scott & Company, Chicago. One of the truck drivers is employed to operate the tractor, and the two others were given other work by the company.

This equipment is used for inter-warehouse hauling where the distances are short and where there is likely to be considerable delay in loading and unloading. Until quite recently such conditions were considered to be especially favorable for the use of horse-drawn trucks. Inasmuch as the electric trailers can be parked for loading or unloading without rendering idle any motive power or drivers, it takes very little arithmetic to show which investment is more to be favored. When the horse-drawn trucks were used all three trucks were likely to be on the street at the same time, but now only one electric motor trailer is on the street, thus relieving street traffic congestion.

With the use of the entirely closed steel electric trailers there is not the chance of packages being stolen or lost by dropping on the street that there was with the open-ended, tarpaulin-covered horse trucks. In addition, the merchandise is better protected from the weather. Operations with the new arrangements have proved to be superior to those using horse-drawn vehicles.

Digest of Electrical Literature

Generation, Control, Switching and Protection

Rectifier Voltage Control. — D. C. PRINCE.—Lack of voltage control is one of the objections which have been made to the use of rectifiers. The author describes a method of voltage control for rectifiers based on the use of a saturated-core interphase transformer. Saturation of this device produces a gradual change from two three-phase rectifiers operating in parallel to one six-phase rectifier, which has a higher inherent voltage ratio. The theory of operation is discussed, and supporting oscillograms and observed regulation curves are shown. — *Journal of A.I.E.E.*, July, 1926.

Electric Supply of Norway. — N. SCHULZ.—According to the electrical census of Norway, ending with the year 1923, the developed main water power of that country amounts to about 10,000,000 kw., corresponding to a possible production of 80,000,000,000 kw.-hr. annually. During 1920 Norway imported 1,700,000 tons of coal. More than 70 per cent of the 2,500,000 inhabitants of Norway are being supplied with electric power. The total demand of the country averages 2/10 kw. per inhabitant. The average load factor of the various plants is 0.50. This high factor is due to very low rates and to the extended use of flat rates. The highest generating peak during 1923 was reached with 325,000 kw., or 1,500,000,000 kw.-hr., which gives 800 kw.-hr. as the average use in that year by each inhabitant. The highest transmission voltage in use in Norway is 132 kv.—*Elektrotechnische Zeitschrift*, June 10, 1926.

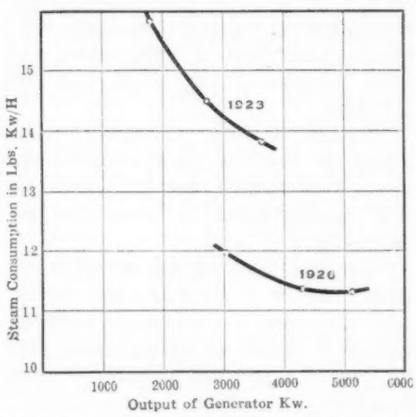
Transmission, Substations and Distribution

General Theory of the Auto-Transformer. — WALTER L. UPSON. — The method of complex quantities lends itself to the development of a general theory of the auto-transformer. Worked out in this instance, it is found desirable to maintain the actual voltage ratio instead of reducing values to an equivalent one-to-one basis. Examples are given of calculations by this method, and comparison is made also with calculated performance of the two-circuit transformer. Certain inherent peculiarities of the auto-transformer are pointed out, these being due to the effects of internal resistance and reactance.—*Journal of A.I.E.E.*, July, 1926.

Hydro-Electric Development and Steam Equipment

Station Piping.—This is a serial report of the prime movers committee which has been edited from the report of the station piping sub-committee and contains proposed tentative specifications for power-station piping systems. These specifications cover manufacture, chemical properties and tests, physical properties and tests, workmanship and finish, marking, inspection and rejection, and conclude with explanatory notes.—*Bulletin of N.E.L.A.*, June, 1926.

Tests of Turbo-Generator Sets.— For the Fort Island Road generating station of the city of York the Oerlikon company has supplied two 3,500-kw. sets and one 6,000-kw. set, designed for a speed of 3,000 r.p.m. The acceptance tests of the 6,000-kw. machine took place in February and those of the second 3,500-kw. set earlier in the same month. A comparison of the results is of interest, for great improvement has been obtained as regards both efficiency and steam consumption per kilowatt-hour with the last set. In the chart, the steam consumption per kilowatt-hour as a function of the output is graphed, and it will be seen that the steam-consumption figures are much lower in the case of the 6,000-kw. set. This improvement is attributable to the increase of steam temperature and vacuum, and also to the higher total efficency of the 6,000-kw. machine.—*Engineer* (*England*), June 11, 1926.



COMPARISON OF STEAM CONSUMPTION OF TURBO-GENERATORS

Units, Measurements and Instruments

Localizing Faults in Overhead Lines. —P. BERNETT and R. ARNOLD.—Many methods are known and widely used to localize a fault on underground cables. Virtually no method at all comparable in accuracy is known for similar procedures on overhead lines. The writers have proposed such a method and had occasion to test it on an extended South German power system. The results were highly satisfactory, as it was possible to determine the fault in all cases to a distance not exceeding the span between three towers. The principle of the method is to measure the reactance of the loop "line-fault-ground" with a specially built reactance meter calibrated directly in miles-distance. Applying certain corrections, the method is also applicable to double lines, permitting fault localizing on one line while the other line is alive. While the method is primarily intended for high-voltage lines, it may under certain circumstances be applicable also to low voltage networks. — *Elektrotechnische Zeitschrift*, June 10, 1926.

Zero Method of Measuring Power with the Quadrant Electrometer.—W. B. KOUWENHOVEN and PAUL L. BETZ. —This paper describes a zero method of measuring power by means of the quadrant electrometer developed by the authors and which is believed to be new. Zero deflection of the electrometer is obtained by opposing the torque produced by the alternating-current load by means of a counter torque set up by continuous potentials introduced into the electrometer circuit.—*Journal of A.I.E.E.*, July, 1926.

Cathode-Ray Oscillograph for Several Simultaneous Waves with Stabilized Linear Time Axis. — FREDERICK BEDELL and H. J. REICH.—A linear time axis for a cathode-ray oscillograph is obtained by repeatedly charging a condenser through a saturated thermionic rectifier and discharging through a neon lamp when a critical voltage is reached. The period controlled by condenser capacity and rectifier filament current can be made approximately synchronous with periodic phenomena under study, so that the oscillograph shows a nearly stationary wave in rectangular co-ordinates. For certain alternating-current study precise synchronism is obtained by introducing some of the alternating current into the neon circuit, thus synchronizing the discharge of the condenser, without affecting its uniform rate of charge. This is an absolutely stationary alternating-current wave, irrespective of its source or frequency. By persistence of vision two or more waves can be readily obtained simultaneously by a motor-driven switch, making connection to the several sources rapidly in succession.—*Science*, June, 1926.

Illumination

Illumination of a Large Reading Room.—H. H. HIGBIE.— While this paper does not pretend to be comprehensive and exhaustive, most of the important considerations in design of illumination for a reading room are reviewed here as they apply to a large university library. An unusual application of cove lighting to produce general illumination and a distinctive special design of lamp to produce local illumination on tables are described and illustrated, and tests of performance are given. Data on the deterioration of an indirect system over a period of years appear incidentally.—*Transactions of Illuminating Engineering Society*, July, 1926.

Lighting the Air Way.—CAPT. J. E. WHITBECK.—This paper presents an outline of the developments which have been made in the field of illumination as applied to night flying. The problems encountered in establishing and lighting the landing fields and the air way between them on the New York and Chicago night mail route are discussed, and an account is given of the experimental flights which were made in connection with the location of beacons and the lighting of the terminal

fields under various conditions of service.—*Transactions of Illuminating Engineering Society*, May, 1926.

Methods of Manufacture of Neon Illuminating Tubes.—R. W. LOHMAN.—The method of procedure in filling glass tubes with a gas to be used for electrical illuminating purposes is described. The dimensions of neon tubes, or of any gaseous conductor, and its effect on conductivity and light emissivity are outlined.—*Transactions of Illuminating Engineering Society*, May, 1926.

Heat Applications and Material Handling

Tests on Welded Rail Joints.—The American Electric Railway Association and the American Bureau of Welding united in an authoritative investigation of various types of welded rail joints in commercial use through a representative committee which was organized late in 1921. As a result of the committee's activities several progress reports have been issued, of which the one under consideration is No. 4. It is devoted to test data and findings in connection with the repeated impact tests made to determine the present state of the art. No attempt has been made to formulate a conclusion. The welds were of various kinds and not exclusively electrical. The results are given in diagrammatic form with numerous photographs of broken joints.—*Journal of American Welding Society*, July, 1926.

Motors and Control

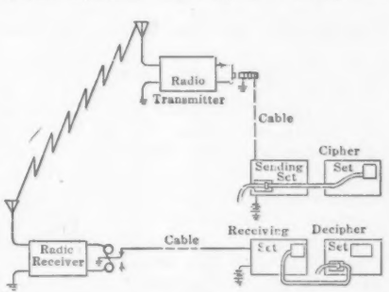
Automatic Control of Edison Lighting Motor-Generator Sets.—H. BANY and G. R. MCDONALD.—The article discusses the application of automatic control to machines feeding direct-current networks. Constant voltage and continuous service are the prime essentials. The type of control described takes full advantage of favorable machine characteristics. Considerable space is devoted to the subject of protection and operation of single units and multiple-unit installations.—*General Electric Review*, July, 1926.

Electrophysics, Electrochemistry and Batteries

Electrical Energy Direct from Coal?—JOHN E. A. RHODIN.—As a scientific curiosity one can say that the problem indicated by the title of this article has been solved, but as the basis of a practical industry it still remains. Even the fundamental idea of a solution is lacking. The author points out that in the nineties of the last century many attempts were made to produce a voltaic combination utilizing coal or carbon as the positive element. He then traces various experiments made to use fused electrolyte and to utilize the heat of combustion of hydrogen for developing an electromotive force. He follows this with a discussion of the possibility of using catalyzers for the ionization of gas in order to facilitate the electrochemical action. As an example he considers the possibility of forcing a gas like hydrogen into the pores of spongy lead in a storage battery in such a manner as to make the gas oxidize instead of the lead itself. As a source of hydrogen he considers the distillation of raw coal but suggests that this process is not very promising. With reference to the direct conversion of radiant heat into electrical energy he raises such questions as the following: "Radiant heat being a kind of transversal vibration of the ether, could it not be transformed into higher frequencies? Is it so certain that some more efficient recipient than thermocouples may not exist? In all arrangements known to us radiant heat reappears as heat, but as the wave length diminishes and vibration becomes luminous we see certain salts decompose into electrical opposites. Why do good conductors let both heat and electricity pass but not light? Why do we get electrical induction and not heat induction?" He suggests that a clew may come from some of the new studies in colloidal chemistry, where a change of molecular aggregation takes place apparently independently of quantity of the acting agents.—*Engineer (England)*, July 23, 1926.

Telegraphy, Telephony, Radio and Signals

Cipher Printing Telegraph Systems for Secret Wire and Radio Telegraphic Communications.—G. S. VERNAM.—This paper describes a printing-telegraph cipher system developed during the World War for the use of the Signal Corps. The system is so designed that the messages are in secret form from the time they leave the sender until they are deciphered automatically at the office of the addressee. The operation of the equipment is described, as well as the method of using it for sending messages by wire, mail or radio. The paper also discusses the practical impossibility of preventing the copying of messages, as by wire tapping, and the relative advantages of various codes and ciphers as regards speed, accuracy and the secrecy of their messages.—*Bulletin Reprint* B-198, *Bell Telephone Laboratories*, June, 1926.



ENCIPHERING AND DECIPHERING SYSTEM

Polarization Changes Caused by Ground Absorption.—E. F. W. ALEXANDERSON.—In the reception of short waves it is often observed that the signal comes in apparently with equal strength from all directions. Measurements with a loop indicate the presence of a horizontal and a vertical wave component with different velocities of propagation, resulting in differences of polarization from point to point. The author discusses the phenomenon, using as an analogue sound waves proceeding from a loud-speaker horn. He suggests that the earth may absorb the horizontal polarized waves and reflect the vertical waves, thus giving rise to a twisting wave spiral.—*General Electric Review*, August, 1926.

Traction

London Electric Railway Extension.—This article is the first of a series and deals with the Charing Cross and Kennington extensions. It deals primarily with the construction features of the extensions and is liberally illustrated with maps and cuts.—*Engineer (England)*, July 23, 1926.

High Voltage Direct-Current Testing Equipment.—For the routine testing of large machines and cables, high-voltage direct current has distinct advantages, especially when the apparatus under test has large electrostatic capacity. It is well known that if under these conditions alternating current be employed, the kilovolt-amperes required to supply the charging current necessitates the use of a heavy and expensive testing plant. In order to test a 6,600-volt, 50-cycle cable, 2 miles long, at 12,000 volts, a 60-kva. testing transformer would be required, while a 5-mile length of 33,000-volt, 50-cycle cable, tested at 50,000 volts, would necessitate the employment of a 1,250-kva set, and approximately 2,200 kva. if tested at 66,000 volts. When a continuous-current testing set is employed, however, the only current that flows, once the cable has been charged, is the sum of the resistance leakage and absorption currents of the insulation, and as these currents amount to only a few milliamperes, it is clear that the direct-current testing sets are very much lighter than the alternating-current sets. Their capacity is relatively small and they are cheaper to construct. *Engineer (England)*, June, 1926.

Improvement Made in Rolling Stock of British Tramways.—Replacement of obsolete rolling stock has made rapid progress in Great Britain since the early part of last year, the proportion of new tramway cars ordered to the total number owned being considerably greater than in the United States during the same period. New buses also have been bought in large numbers by the tramways, but the extensive improvements made in the rail equipment reflect clearly the conviction of the managements that the latter will continue to be the principal means of mass transportation. More than 672 new cars are included in recent orders. Much reconstruction has been done to promote passenger comfort, and modernization of motors has resulted in greater speed.—*Electric Railway Journal*, June, 1926.

Miscellaneous

Transmission and Absorption of Sound by Some Building Materials.—E. A. ECKHARDT and V. L. CHRISLER.—This paper contains a report of the work on sound transmission through partition walls and on the sound-absorbing properties of some of these walls, as well as of various other materials commonly used in building construction. A description is given of the new sound chamber erected for

the purpose of this work; details of the experimental methods are described, and relative results of both transmission and absorption measurements tabulated. It is found that so far as transmissivity goes certain panels are sufficiently opaque to sound to reduce a sound of painful intensity to complete inaudibility. The poorest panels tested were capable of reducing such a sound to about the intensity of the ordinary speaking voice. — *Bulletin No. 526, Bureau of Standards.*

Twenty-Ton Electric Coaling Transport.—The duty of this transporter is the rapid loading of coal into vessels from a pier 500 ft. long and 84½ ft. wide. To this pier the coal is brought in hopper trucks by the use of four sets of rails, and by the operation of the transporter it may be delivered into the holds of ships on either side of the pier, at the same time if necessary. There are two electric capstans, each of a two-speed type, which are placed centrally at the end of the jetty, while guide bollards lead the haulage ropes to each line of rails for the manipulation of the coal trucks beneath the transporter. In the cab above the transporter there is a 15-hp. boom derricking motor. In each trolley there is an electric motor of 100 hp. for use in hoisting and a cross-traversing motor of 30 hp. All the electricity supply is three-phase alternating current at 415 volts and 50 cycles.—*Engineering (England)*, July 2, 1926.

New Books

Electrical Characteristics of Transmission Circuits

Compiled by William Nesbit. East Pittsburgh, Pa.: Westinghouse Technical Night School Press.

This book consists of more or less detailed reviews of the work of many investigators in the field of transmission of electrical energy. The word "review," however, is not used here in the sense that the matter presented in this book is sketchy and merely fragmentary. To imply so would be far from the truth. The great progress which has been made in the art of electrical transmission in the past few years has left many engineers far behind, and this book furnishes an excellent means for them to catch up without the large, and usually indefinitely postponed, study of the papers which are being continually presented on single phases of the subject. Graphic methods for the practical solution of transmission-line problems, and accurate mathematical methods as well, are presented. Tables of constants for varying conditions of the problem are included in great number. This book should be of definite value to the engineer who undertakes the job of designing a transmission system or of prescribing the conditions under which it is to be operated.

Popular Research Narratives

Vol. II. New York: Engineering Foundation. 174 pages, illustrated.

Tales of discovery, invention and research for popular consumption have been compiled in this second volume, published under the auspices of the Engineering Foundation. The narratives range over the whole field of science and discovery and serve to illustrate the fascination that this field has for pioneers.

The book's finest feature lies in the simple, clear style used in the narratives, making them understandable to any reader. The greatest objection to the book is that the narratives are far too brief. Greater elaboration of each topic would have brought completeness without any sacrifice of interest. In some respects, too, the subject matter is open to criticism. A would-be humorous story concerning magnetic effects on restaurant silver is a little too far afield from science and discovery. Several other narratives are about subjects of minor importance as compared with possible subjects coming within the realm of treatment.

The publication of works of this character should be encouraged because of their educational value and their aid in building public recognition for research activities.

Economics of the Radio Industry

By Hiram L. Jones. Chicago: A. W. Shaw Company. 332 pages, illustrated. Price, $5.

The author presents in an interesting and readable manner the subject of the economics of the radio industry. The book contains information of value to the manufacturer, retailer, wholesaler, financier, engineer and broadcast listener. Much material not directly concerned with the economic aspect of the subject is included which is of interest to the general reader. The author has brought out in convincing fashion some of the difficulties encountered in connection with the protection afforded by copyrights. It will be worth one's time to read carefully the section on "Patents as a Property Problem" in order to gain an appreciation of the many complications involved. In view of pending legislation the section on "Public Policy and Control" is of wide interest, dealing as it does with national and international communication problems. H. M. T.

Hydraulics

By Joseph M. Le Conte. New York: McGraw-Hill Book Company, Inc.

This is wholly a textbook. Probably in no other branch of the engineering art is use so largely made of empirical formulas which are in many cases obviously the results of researches in that old school of "cut and try." Mr. Le Conte attempts, and one would say rather successfully, to bring to the light of comprehension those basic principles of hydraulics that underlie the practical empiricism of every-day use. The exposition of these principles is made entirely by means of mathematical analyses of the conditions in which the principles obtain. Those hydraulic engineers who use the classic eleven formula for determining the power of a falling stream and find it sufficient for their purposes will not be tremendously thrilled by Mr. Le Conte, but the others, who want more than a rule of thumb, will find here the knowledge they have been seeking.

Mathematics for Engineers

By Raymond W. Dull. New York: McGraw-Hill Book Company, Inc. 780 pages. Price, $5.

After leaving college and getting out into the field the average engineer usually finds that he is carrying in his head a lot of mathematics for which he has no immediate use. The common practice is to shove this mental lumber off into a dark corner of the brain, and when a particular piece of it is needed for the solution of a problem frantic search reveals the fact that the whole pile has resolved itself into an amorphous mass of indistinct memories and unrelated major impressions. For such engineers—and their number is legion—Mr. Dull's book must come, as Bill Nye would put it, as an unqualified boon. Here are all the rules and concepts that only dimly persist in memory set down in enduring print and ready at the turn of a page to metamorphose that wraith-like recollection into solid understanding. One may go further and state that the material in this book stands by itself and needs no previous mathematical instruction as a foundation of perception. It seems to the reviewer that any engineer who has gone so far in his profession as to require the use of differential calculus, say, to solve a problem must be of sufficient intelligence to understand the principles of that mathematical exercise from the exposition of Mr. Dull. The subjects covered in the book range from simple arithmetic through algebra, trigonometry, analytic geometry, calculus and the whole field of applied mathematics.

Book Notes

Kurzschlussströme beim Betrieb von Grosskraftwerken. By R. Rüdenberg. Berlin: Julius Springer. 75 pages, 60 illustrations.

Written as a reference book for operating engineers of large power stations, this small volume contains in condensed form the causes, manifestations and protections against short circuits such as form the major part of disturbances in large power systems. Graphical representation and oscillographic records are used throughout the book. Great attention is paid to the various methods known to interrupt heavy short-circuit currents quickly and safely.

The "Electrician" Annual Tables of Electricity Undertakings for 1926. London: Benn Brothers, Limited.

This publication covers the same field in Great Britain and her colonies as does the McGraw-Hill Central Station Directory in the United States. It includes also data on a considerable number of continental European, Asiatic and African cities. The compilation is made by city names, each city item presenting information on plant capacity, rates, population, management, etc.

Electrical Precipitation as Applied to Gas Streams. By H. R. Hanley. Bulletin of the School of Mines and Metallurgy, University of Missouri, Columbia, Mo.

The subject matter of this paper is largely taken from the literature of the art. The idea prompting this compilation and discussion was inspired by the dearth of segregated data dealing comprehensively with the fundamentals and practice of the process of electrical precipitation.

News of the Industry

Interconnection Advances in California

Completion of 105-Mile, 220-Kv. Transmission Line Between Great Western and San Joaquin Systems First Link in High-Power State Bus of Future

EVERYTHING was in readiness for the celebration on Friday, Aug. 13, of the opening of the Wilson substation at Merced, Cal., the southern terminus of the 105-mile, 220-kv. tie line between the systems of the Great Western Power Company and the San Joaquin Light & Power Corporation. State and local officials from nearly all parts of California, together with civic and industrial leaders and several hundred specially invited guests and stockholders of the two companies, were to join with employees of all grades in witnessing the ceremonies and entertainment. The honor of throwing the switch that would put the plant on the line was assigned to Miss Maxine White of Bakersfield. Richard Shaffer, president of the Merced Chamber of Commerce, was to preside over the ceremonies, the principal address being scheduled for delivery by Lester S. Ready, chief engineer of the California Railroad Commission, with briefer addresses by A. Emory Wishon, vice-president of the San Joaquin company, and J. B. Black, vice-president of the Great Western.

L. S. READY

A. E. WISHON

J. B. BLACK

With the completion of the tie line between the two systems one of the greatest steps forward of recent years in California's electrical development has become a reality. Not only does this line tie together the power resources of two of the biggest operating companies of the Pacific slope, but it strengthens interconnection of systems throughout the length of California and makes possible interchange of substantial blocks of power from the Mexican border to the Oregon line.

California, with the most extensive hydro-electric development in the Union, years ago realized the common advantage of interconnection between its power systems. In periods of emergency, such as might be occasioned by a season of drought or by a breakdown or by increase of demand beyond the immediate capacity of an individual company, it has been possible through tie-in stations to shift load from one end of the state to the other and thereby maintain everywhere uninterrupted service. These interconnections have, however, offered only a limited capacity of exchange and have been created to meet an immediate emergent situation. The new tie line of the Great Western and the San Joaquin, ultimately to operate at 220,000 volts, is generally regarded, therefore, as the first real link in a state transportation bus for power interchange that will meet all demands of the future.

Built with this thought of thorough and substantial state interconnection in mind, the primary purpose of the line is to conserve the water and fuel resources of the two interested companies, which are the Pacific Coast auxiliaries of the North American Company of New York. These companies, it will be remembered, came under the control of the Western Power Corporation of New York in 1924, when this holding company, which had previously operated the Great Western Power Company, purchased the common-stock holdings of the San Joaquin Light & Power Corporation. Subsequently the Western Power Corporation of New York became one of the allied properties of the North American Company, with H. P. Wilson of New York still retaining the presidency. The tie line which has just been completed was projected by Mr. Wilson.

The Great Western Power serves the San Francisco Bay district and the cities, towns and farms in the Sacramento and Napa Valleys of northern California. Its hydro plants are in Plumas County, where an enormous watershed, feeding the Feather River, runs its waters into Lake Almanor, with a capacity of 1,357,000 acre-ft. The San Joaquin Light & Power Corporation, with its auxiliary, the Midland Counties Public Service Corporation, serves the San Joaquin Valley counties of Mariposa, Merced, Madera, Fresno, Tulare, Kings and Kern and the Coast counties of Monterey, San Luis Obispo and Santa Barbara. Its hydro plants, twelve in number, are located along the rivers flowing from the Sierra Nevadas into the valley, several of them stream-flow plants and others drawing their water from a huge reservoir in Crane Valley, 50 miles from Fresno. There are two steam plants, maintained for stand-by service, in Kern County, operating with natural gas from the oil fields.

The two companies have a combined connected load of 675,000 kw. The Great Western's chief consumers are the factories of the San Francisco Bay district. The San Joaquin carries a substantial industrial load, chiefly in the packing houses of the fruit-growing sections and in the oil fields, but its service is largely agricultural, with more than 9,000 farms connected to its lines. In consequence the peak loads of the companies come at different times of the year and the peak demands at different times of the day. Here lay the inspiration for the interconnection, which is a steel-tower line of the most modern design, starting at Brighton, near Sacramento, in the Great-Western territory, and running through the very heart of central California to the Wilson substation at Merced. More than $2,000,000 is represented in the cost of the line, with an additional $750,000 invested in the substation. It permits the transmission of electricity generated in the hydro-electric plants a distance of approximately 450 miles, with laterals distributing energy to an average width of 150 miles.

"Primarily we are providing for California growth," said Mr. Wilson, after whom the new substation is named. "We are also keeping in line with modern electrical development, which seeks constantly for economies and improved service which may benefit the consumer. The tying together of these two systems will make it possible for us to store water in Lake Almanor which would otherwise go to waste. When this water is coming into Lake Almanor the Great Western will depend for much of its power upon the San Joaquin supply. When Lake Almanor is full the San Joaquin reservoirs may be low, and then the process will be reversed and San Joaquin will be supplied substantially from the Great Western sys-

tem. This conservation of water resources will mean economical power production the year around. It will obviate the necessity of continuous operation of steam plants and thus effect a big saving in both natural gas and oil, which are used as fuel. It will postpone for a time too the necessity of increased plant capacity and will also make it possible to effect additional economies when such plants are built, as a plant can be built on one system which will adequately take care of the growth of two systems.

"The tie line places the standby service of each system at the disposal of the other. It also establishes an effective insurance factor in the operation of both systems in case of a heavy breakdown that might put a power plant or a transmission line out of business. Obviously this conservation of floodwaters and the use of generating and transmitting facilities in common reduces the amount of investment in such facilities on both systems as against what each would have had to invest otherwise. Ultimately this will mean a reduction of cost of service to the consumer."

Rushing a Tie-in to Completion in South California

Concentrating more than 800 trained transmission-line workers on the task, the Southern California Edison Company on July 31 completed a 26-mile tie-in line between the lower Kern River No. 1 hydro-electric plant, about 18 miles northeast of Bakersfield, and Vestal substation, south of Porterville, according to George C. Ward, vice-president in charge of construction and operation for the company. Energy generated on the lower Kern River is made available to the San Joaquin Valley consumers this summer by this record-breaking achievement, and the company has again demonstrated that it is capable of meeting any emergency condition which may arise in serving its customers.

Late in June of this year it became apparent to the Edison company that the rapid increase in consumption of electricity in the San Joaquin Valley was going to make it necessary to take steps to furnish an additional supply of 60-cycle energy for this territory. All other Edison territory is now using 50 cycles, and, realizing that the installation of additional frequency-changer capacity at Vestal substation could not be accomplished in time to help the situation this summer, plans were immediately made to construct a line which would make it possible to divert the energy generated in Kern River No. 1 at 60 cycles directly into the valley. To do this it was necessary to build 6 miles of line from the power plant to the right-of-way of the new 220,000-volt transmission line, known as the Vincent line, now under construction, and to bring to immediate completion approximately 20 miles of this Vincent line, extending north to the intersection of this line and the line connecting the upper Kern River plant near Kernville and Vestal substation. Experienced crews from all parts of the Edison system were immediately brought into the valley to reinforce the regular maintenance crews of this territory, and on the first of July actual work was started. The line is now energized at 60,000 volts.

A.I.E.E. Coast Convention

Technical Program for Salt Lake City Ready—Presentation of the Edison Medal—Inspection Trips

ARRANGEMENTS for the Pacific Coast convention of the American Institute of Electrical Engineers, to be held at Salt Lake City on Sept. 6 to 9, are well advanced. Headquarters will be at the Hotel Utah. As will be seen from the program of technical papers given herewith, the many subjects covered will include high-voltage transmission, corona, surge recorders, vacuum switching, fire protection for generators, stability of alternators, protecting oil tanks against lightning, telephony, mining applications and education.

An especially interesting event will be the presentation of the Edison medal for 1925 to Dr. Harris J. Ryan, past-president of the Institute and professor of electrical engineering at Stanford University, California. This will take place at the annual dinner, to be held on the evening of Sept. 8.

Inspection and sight-seeing trips will fill the afternoons. These are to include visits to the Utah Copper Company's mines and mills at Bingham and Magna, where great quantities of electric power are used; to Saltair, the unique resort on Great Salt Lake; to the canyons in the neighborhood, and to the many points of interest in Salt Lake City itself. On Friday, following the convention, those desiring to do so will visit the hydro-electric plants of the Utah Power & Light Company. A trip of two days' duration will cover the Bear Lake-Bear River system, and there will be a one-day trip to the 30,000-kw. Cutler generating station, which will be placed in operation in the latter part of this year.

Technical Program of Pacific Coast Convention of A.I.E.E.

MONDAY, SEPT. 6

AFTERNOON

"The Space Charge That Surrounds a Conductor in Corona," H. J. Ryan and J. S. Carroll, Stanford University.

"110-Kv. Transmission-Line Construction of the Washington Water Power Company," L. R. Gamble, Washington Water Power Company.

"A New 220-Kv. Transmission Line," C. B. Carlson and H. Michener, Southern California Edison Company.

"Effect of Unbalanced Tension in a Long-Span Transmission Line," E. S. Healy and A. J. Wright, Electric Bond & Share Company.

TUESDAY, SEPT. 7

MORNING

"The Circle Diagram of a Transmission Network," F. E. Terman, Stanford University.

"Calibration of Lichtenberg Figures," K. B. McEachron, General Electric Company.

"Fire Protection of Alternating-Current Generators," J. A. Johnson, Niagara Falls Power Company, and E. J. Burnham, General Electric Company.

"Stability Characteristics of Alternators," O. E. Shirley, General Electric Company.

"Synchronizing Power in Synchronous Machines," H. V. Putman, Westinghouse Electric & Manufacturing Company.

AFTERNOON

"Vacuum-Switching Experiments at California Institute of Technology," R. W. Sorensen and H. E. Mendenhall, California Institute of Technology.

"Economical Power-Factor Correction," H. S. Litchfield, Providence, R. I.

"Electrical Practice in Lead-Silver Mines in Utah," Leonard Wilson, consulting engineer.

"Engineering Education—Its History and Prospects," H. H. Henline, Stanford University.

WEDNESDAY, SEPT. 8

MORNING

"Protection of Oil Tanks Against Lightning," F. W. Peek, Jr., General Electric Company.

"Protection of Oil Tanks Against Lightning," E. R. Schaeffer, Johns-Manville, Inc.

"Variable-Voltage Equipment for Electric Power Shovels," R. W. McNeill, Westinghouse Electric & Manufacturing Company.

"Mercury-Vapor Power Rectifier," C. A. Butcher, Westinghouse Electric & Manufacturing Company.

"Temperature of a Contact and Related Current-Interruption Problems," Joseph Slepian, Westinghouse Electric & Manufacturing Company.

THURSDAY, SEPT. 9

MORNING

"Transcontinental Telephony," O. B. Jacobs and H. H. Nance, American Telephone & Telegraph Company.

"Controlling Insulation Difficulties in the Vicinity of Great Salt Lake," B. F. Howard, Mountain States Telephone & Telegraph Company.

"Carrier-Current Communication on Submarine Cables," H. W. Hitchcock, Pacific Telephone & Telegraph Company.

Program Mapped Out for Eau Claire Convention

Arrangements have been completed by John N. Cadby, executive secretary of the Wisconsin Utilities Association, for the annual convention of the Electric Section of the association, which will be held at the Eau Claire Hotel, Eau Claire, on Sept. 3 and 4. Public relations, radio interference, rural electrification and coal distillation for steam plants are some of the outstanding topics on the program.

Mayor John E. Barron, John St. John, president of the association, and George G. Post, chairman of the section, will speak officially. Other speakers on Friday morning are to be L. J. Beckwith, Milwaukee, on "Radio Complaints an Aid to Utilities"; William C. Lounsbury, Superior, on "How the Operating and Construction Man May Make Friends for His Company"; R. L. Dodd, Milwaukee, on "All Utilities Facing Underground Problems," and R. G. Walter, Madison, on "Rural Electrification Popularizing the Farm." In the afternoon C. M. Jansky of the University of Wisconsin will speak on "The Education of Metermen"; E. S. Schrank, Oshkosh, on "Serious Effects of Fractional-Horsepower Motors on System Power Factor," and M. K. Drewry, Milwaukee, on "Twelve-Hundred-Pound Pressure and Low-Temperature Coal Distillation for Steam Plants." Committee reports will include one on the progress of electric fellowship work at the University of Wisconsin. The annual dinher-dance will be held in the evening.

Saturday will be devoted to an inspection trip of the Jim Falls and Wissota hydro-electric plants of the Northern States Power Company, which may be followed by entertainment in the way of golf, fishing, boat and automobile trips.

Preparing for Great Lakes Section Convention

Addresses are to be given at the sixth annual convention of the Great Lakes Division of the National Electric Light Association, to be held at French Lick, Ind., on Sept. 23-25, by R. F. Pack, president N.E.L.A.; S. D. Heed, president Hurley Machine Company, Chicago; E. W. Lloyd, vice-president Commonwealth Edison Company; Dr. Theo. Grayson, University of Pennsylvania; W. A. Jones, chairman Public Relations National Section, and Managing Director M. H. Aylesworth. Miss Isabell Davie and Miss Elizabeth Lee will discuss women's work by committee and in the industry; Prof. G. I. Christie of Purdue University, recent developments in rural electrification; Vice-president P. H. Palmer of the Northern Indiana Power Company, how to get prompt collections while maintaining good public relations, and Donald M. Mackie, Consumers Power Company, the advertising of merchandise.

Other addresses or papers will be: "Public Utility Financing and the Investment Banker," Chester Corey, vice-president Harris Trust & Savings Bank, Chicago; "The Electrical Manufacturer," E. H. Sniffin, Westinghouse Electric & Manufacturing Company; "Commercial Possibilities of Residence Lighting," M. Luckiesh, president Illuminating Engineering Society, and "Physical Research Methods in the Study of Dielectric Materials," John S. Lapp, Lapp Insulator Company, Le Roy, N. Y. Entertainment will be amply provided.

Holt Sees American Capital Drawn by Quebec Power

Commenting on Canadian conditions in an interview with the *Financial Times*, while in London recently, Sir Herbert Holt, Montreal financier, who is closely identified with a number of leading Canadian power enterprises, had the following to say in regard to the power situation in the Dominion:

"Water-power development is in its infancy in Canada. With the prohibition of the export of power from Quebec and Ontario, American capital and American enterprise are naturally being attracted to the field of Canadian water-power development. It is the old story of Mahomet and the mountain. United States industrialists cannot secure a supply of power from Canada by transmission, and they are compelled, if they wish to avail themselves of the new and comparatively unexploited resources across the border, to establish plants in the Dominion. Take, for example, the Aluminum Company of America's great project on the Saguenay River in the Province of Quebec. Had there been no embargo on the transmission of power from Quebec to the United States, in all probability this American corporation would not have erected a Canadian plant with its capacity of 800,000 hp., and Canada would have been the loser thereby.

"With this water-power development proceeding apace, it naturally follows that we have to look further afield for water-power resources. Only recently I made the statement to Mr. Taschereau, Premier of Quebec, that within twenty-five years all the water power within what may be described as the Montreal area would be under actual development and that it would then behoove Canadian industries dependent upon water power to look in other directions within the Dominion for their supply of power. Fortunately, however, there is still a comparatively unlimited supply available, and for many years to come Canadian and American capital will be actively engaged in developing these untapped resources."

Senator Harrison Optimistic on Muscle Shoals Bill

A motion to take up the Muscle Shoals bill will be made during the first few days of the next session of Congress, Senator Harrison of Mississippi says in a formal statement. He believes that the bill can be made the unfinished business, which will insure its passage. The Mississippi Senator reiterates his previous declaration that the offer of the associated Southern power companies is by far the best proposal that has been submitted and is confident that this view will eventually prevail with the majority in both houses.

Federal Power Commission's Activities

New River Plant Will Affect Navigation of Kanawha—Klamath River Development and the Fisheries—St. Lawrence River Application Amended—Nolichucky Project

REPORTING to the Federal Power Commission, the Chief of Engineers of the army finds that the proposed development of the New River Development Company above Radford, Va., on New River will affect navigation in the Kanawha River. This means that the development must be made under the jurisdiction of the commission. The report disposes finally of a very much controverted case in which the New River Development Company urged that under the method which it proposed there would be no adverse effect on navigation in the Kanawha.

The Electro-Metals Company of San Francisco has applied for a year's extension of its preliminary permit covering a proposed development on the lower Klamath River. The company's present preliminary permit has run for two years. Work under it has been suspended since the passage of referendum measures in California making a state fish and game reservation on the Klamath below the mouth of the Shasta River. This law prohibits construction of any dam or other structure in the stream which will interfere with the migration of salmon. The applicant points out that the law has been under fire ever since its passage and that, as the Klamath is an important power stream, the restrictions may be modified in the future. Another possibility is that some development may take place which will make it possible to use the power resources of the stream without interfering with the run of salmon. A successful runway to enable fish to ascend dams has been built in the Baker River in Washington. As the company has had the project under consideration for eighteen years, it asks that its rights be extended as long as possible.

The American Super-Power Corporation is seeking to amend its application for a preliminary permit covering its St. Lawrence River project. The application was filed Jan. 10, 1923, but never has been acted on by the Federal Power Commission, which has suspended action on all St. Lawrence applications pending an agreement with Canada for the further development of the resources of the boundary streams. The amendment submitted proposes four alternate schemes of development, in accordance with the company's amended application to the New York Water Power Commission. One plans a 27-ft. development at Ogden Island and a 54-ft. development at Barnhart Island. The second plan is for a 75-ft. development at Barnhart Island with a regulating dam only at Ogden Island. A third plan suggests an 85-ft. dam at Barnhart Island only. The fourth plan calls for a 85½-ft dam at Barnhart Island together with a plan for navigation. All the plans contemplate maintaining the 14-ft. navigation now available. The locations were adopted, however, with a view to possible future extension of the controlling depth to 35 ft.

The Southern California Edison Company has applied for an amendment to its San Joaquin River license to cover its lowest development on that river. The site is known as Big Creek No. 4. The plans submitted call for a dam 120 ft. high. Equipment sufficient to develop 107,000 hp. will be installed although the primary power available is only 36,867 hp.

The Tennessee Eastern Electric Company has applied to the commission for a preliminary permit covering the construction of three dams on the Nolichucky River in Tennessee. One of the proposed dams is to be 70 ft. high and is to be 12 miles down stream from the company's present dam. Another dam, 70 ft. high, is to be built at Buckingham Ford. The third dam is to be 90 ft. high and will be at Embreville. It is planned to install equipment rated at 70,000 hp.

Application for a license covering a water-power project in the Tongass National Forest has been made by the Home Power Company of Skagway, Alaska, and the Sunny Point Packing Company of Seattle has applied for a license for a small power development near its cannery on Gunnock Creek, Kupreauoff Island, Alaska.

The Western Colorado Power Company of Durango, Col., has applied for a license covering various transmission lines. Out of a total of 206 miles, 85 miles is on federal lands.

Purchases and Mergers

Activity Continues in Many Sections Without Any Transaction of Outstanding Import

PURCHASE of four light and power and electric railway properties in northeastern Indiana by the Indiana Service Corporation has been authorized by the Indiana Public Service Commission. These properties are the Marion & Bluffton Traction Company, both railway and power property; the Bryant Electric Company, the Wells County Electric Company and the Berne Electric Company. The total valuation is $1,295,992. By this transaction the Indiana Service Corporation, which is a subsidiary of the Midland Utilities Company, will serve 39 communities with light and power and 37 towns will be connected by the company's railways.

Approval has been given by the Kansas Public Service Commission to the sale of the power plants, equipment, property and franchises in the cities of Eureka and Greenwood by the Eastern Kansas Power Company to the Kansas Electric Power Company. The latter company, with headquarters at Lawrence, is a subsidiary of the National Electric Power Company of New York. The sale price was $262,500 plus 4,500 shares of non-par common stock of the Kansas Electric Power Company.

Authority has also been granted by the Kansas Public Service Commission for the absorption of six electric properties by the Kansas Power Company, an operating subsidiary of the A. E. Fitkin interests of New York. These properties, valued at approximately $3,500,000, include the Great Bend Water & Electric Company, Great Bend; Electric Service Company, Dodge City; Liberal Light, Ice & Power Company, Liberal; Phillips County Light & Power Company, Phillipsburg; Central Kansas Public Service Company, Ellsworth, and Hoisington Electric & Ice Company, Hoisington. The Ellsworth and Dodge City properties were valued at more than $1,000,000 each. C. A. Fees is president of the Kansas Power.

A special election has been called for Aug. 31 to vote upon the proposal of the Western Public Service Company to purchase the city-owned lighting, heating and water plant of Sidney, Neb., for $330,500.

Purchase by the Insull interests of a controlling interest in the Albert Emanuel Power holdings grouped under control of the National Electric Power Company, as recorded on July 31, page 235, includes the Southwest Power Company, with plants at Eureka Springs, Springdale, Rogers, Fayetteville, Siloam Springs and Harrison in northwest Arkansas and in McAlester and other Oklahoma towns.

The directors of the Troy (N. Y.) Gas Company, which has an electric department, have advised its stockholders to exchange their holdings for those of the Mohawk-Hudson Power Corporation. Ratification will bring a seventh company into the group owned by the Mohawk-Hudson, which already includes the Municipal Gas Company of Albany, the Adirondack Power & Light Corporation, the Cohoes Power & Light Corporation, the Eastern New York Utilities, Inc., operating in Rensselaer; the Fulton County Gas & Electric Company and the Utica Gas & Electric Company.

A redistribution of properties among the various operating subsidiaries of the Central and South West Utilities Company and a corporate readjustment of the Central Power & Light Company have been made by which the electric properties in the towns of Carthage, Tenaha and Center, in northeastern Texas, will henceforth be owned by the East Texas Public Service Company and the electric properties of Mena and Ashdown, Ark., by the Southwestern Gas & Electric Company. The Texas Central Power Company, serving 56 communities, and the Valley Electric & Ice Company, serving 18 communities, both former subsidiaries of the Central Power & Light Company, have conveyed all their properties to the latter, which will henceforth operate under its own name in these communities.

An offer of $200,000 for the municipal electric light and power plant at Wellington, Tex., has been made by the Central Power & Light Company. The City Council has accepted the offer, subject to an election on Aug. 30.

Approval of consolidation of the Foley Light & Power Company and the Deuel Light & Power Company in Baldwin County, Ala., has been asked from the Alabama Public Service Commission. The name of the company first mentioned is to be retained.

Henry L. Doherty Addresses Institute of Politics

"Our Future Sources of Energy" was the subject of an address made by Henry L. Doherty, president of the Cities Service Company, before the Institute of Politics at Williams College, Williamstown, Mass., on Wednesday, Aug. 4. Mr. Doherty deprecated the waste and prodigal use of primary national resources such as coal and oil, saying:

"There has not been as yet any evidence offered by any one that there are any sources of energy available to mankind other than those which have been known to the scientific world for many decades. Predictions of discoveries about to be made have never been uttered from any source worthy of confidence and if any reasons have been given in justification of these predictions they have not been worthy of a moment's consideration.

"We are drawing on our raw sources of energy at a disturbing rate. We could generate more power than we are now using by our water alone, but this power cannot be generated within transmission distance of our markets and only about 15 per cent of the power we use is being generated from water. The bare statistics on coal would indicate a supply for many decades, but we are rapidly exhausting the highest grade coals—those that can be the most easily mined and the deposits closest to our markets. As for oil, each year brings a greater and a greater demand for liquid fuel. There is no proof and little likelihood we can much longer even maintain our present rate of production."

Electrification at Chicago

Illinois Central Officially Opens 36 Miles of Suburban Tracks to New Motive Power

FORMAL inauguration of electric train service at Chicago took place on Saturday, Aug. 7, with the official opening by the Illinois Central Railroad of the electrified section of its suburban tracks. This is the diamond jubilee year of the Illinois Central, which obtained a charter from the state in 1851, and it was the first time that electric trains had operated on the steam roads of Chicago. The railroad carries more than one-third of all the suburban passenger traffic in that city.

The Chicago terminal improvements include, among other extensive changes, the electrification of the suburban freight and through passenger operations. The initial electric operation handles the suburban traffic from the central station at Randolph to Matteson, 28 miles south; to South Chicago over a 4.8-mile branch and to Blue Island over another branch 4 miles in length. At the present time about 87,000 suburban passengers are handled every weekday on 418 trains. An increase in this business is expected to bring this total up to more than 100,000 passengers in the near future.

In addition to the elimination of smoke, noise and dirt, marked improvements are being made in the running time of trains, reducing the schedules by from 15 to 30 per cent. During the morning rush 57 local, express and special trains are being operated between the hours of 7:30 and 9:30, thus averaging a train every two minutes. During the evening rush, from 4:30 to 6:15, similar service is provided, with a total of 48 trains.

All of the suburban passenger business will be handled with trains made up of equal numbers of 1,500-volt direct-current motor cars and similar trailing units without motors. The initial equipment includes 130 steel motor cars and 85 new trailers which will be used with 45 steel cars now in use, making a total of 130 two-car units. Each motor truck carries two 250-hp. motors and is of the swing-bolster equalized type, having a wheel base of 8 ft. 3 in. The wheels are 38 in. in diameter. The length of run for these trains between stops varies from 0.34 mile for the local service to 14 miles in special service. Each of the four motors has an hourly rating of 250 hp. and a continuous-current rating of 190 hp. The gear ratio is 60 to 21 and provides for a straight line acceleration of 1.5 miles per hour per second and a balancing speed of 57 miles per hour based on the assumption of 1,350 volts at the trolley.

Two pantographs are installed on each motor car, designed for a normal operating height of 22 ft. with a range from 16 ft. to 24 ft. above the rail head. The pantographs are spring-raised and air-lowered and all of the collectors in the train may be controlled from any cab. The control on all of the cars is of the electropneumatically operated type, designated as type PC-103 and built by the General Electric Company.

Two independent electropneumatic line switches are connected in series and arranged to open all circuits under power. The control devices are operated from a 32-volt supply. Acceleration is automatically controlled by means of current-limit relays, but provision is made for positive manual acceleration, if desired. There are seven full-field series steps, five full-field parallel and one normal-field parallel step. The master controller has four running points—switching which is series connection with all resistance in circuit, series, by-pass for manual notching, and parallel for the full running position. The master controller is interlocked with the brake apparatus to prevent the application of power unless the brakes are operated from the same cab.

Power for the entire Illinois Central electrification is supplied by the Commonwealth Edison Company, with which the railroad has entered into a ten-year contract. The Edison company owns and operates seven 1,500-volt direct-current substations located at points specified by the railroad company but maintained and operated by the Edison company. However, the power director of the railroad may give orders relating to the operation of feeders directly to substation attendants. The substation machinery includes 33,000 kw. in synchronous converters and 9,000 kw. in mercury-arc rectifiers. All of the converters are 3,000-kw. sets, each consisting of two 1,500-kw. converters connected in series and receiving power from a single centrally located transformer. The converters, all of General Electric manufacture, are of the shunt-wound type with an overload rating of 300 per cent for one minute.

Work at Grand Falls, N. B., Has Begun

The main contract for the hydro-electric development at Grand Falls on the St. John River, New Brunswick, has been signed and work started this week. The Dominion Construction Company has the contract, awarded by the International Paper Company, which includes construction of the main dam, tunnel and power-house site. The amount involved is said to be in the vicinity of $1,500,000.

Denver's Franchise Election Postponed to October

After a period of almost five months the statistical work in connection with the Denver city government's valuation of the Public Service Company of Colorado's property in that city and neighboring towns has about been completed. Indications are that the company's application for a franchise renewal will be placed before the people at a special election to be held early in October, instead of on Sept. 21, as first planned. The company's last franchise expired on May 15. Ray Palmer, electrical engineer of New York City, in charge of the work, has been retained by the city in an advisory capacity and is expected to render his report in a few days.

As already reported, the franchise will be covered separately from the rate question, although the two will be considered as a unit and one will not be adopted without the other. The franchise will cover only the questions of extensions, service, operation and such matters. Rates will be established by an ordinance as provided in the state constitution, and the rates to be set in the ordinance will be published in advance. Thus the ordinance will not be adopted unless authorized by a favorable vote on the franchise by the taxpayers.

Oregon to Vote on Putting the State in Power Business

Through a ruling of the Supreme Court of Oregon respecting the number of signatures required on initiative petitions to entitle them to a place on the ballot in the November election of this year, the so-called hydro-electric bill sponsored by the Housewives' Council, Portland, will be voted on at that election. The opinion of the court reverses the opinion of the Attorney-General, on which the Secretary of State based a decision to deny the bill a place on the ballot. The court ruling was the outcome of mandamus proceedings brought against the Secretary of State by the Housewives' Council. The Attorney-General had contended that under the law the necessary number of verified signatures was 14,550, and because the petition bore only 13,773, its adequacy was denied. The court interpreted the governing clause of the initiative law on another basis, by which 12,760 signatures were sufficient.

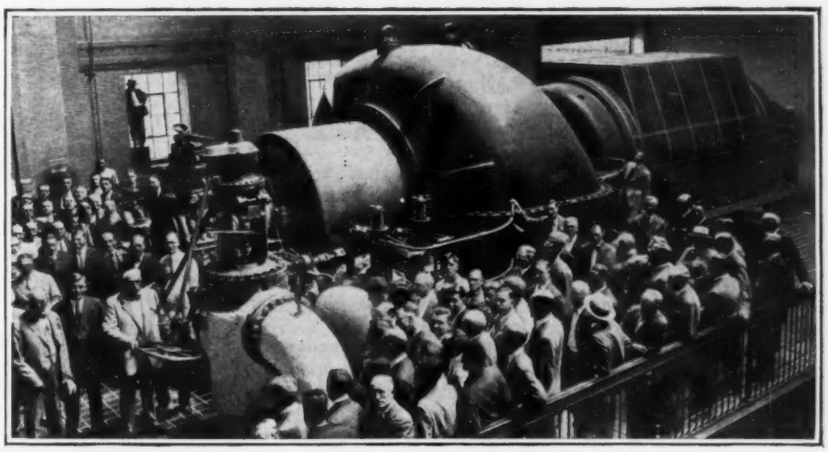
The "housewives'" hydro-electric bill would pave the way for the state to go into the power business, bonding it up to 5 per cent of its assessed valuation, or about $50,000,000.

Interconnection Wins Against Drought in Minnesota

With the Mississippi River at the lowest level since 1875, according to records of the Minnesota Power & Light Company, power generated at that company's dam on the St. Louis River is being relayed 200 miles over the Minnesota Iron Range territory and south again to territory served by the company in central Minnesota. The water in the Mississippi River at Little Falls and Blanchard, at which points the power company has large storage dams, is so low that instead of having surplus power that might be relayed to the Iron Range points, power is being sent the other way from Duluth and from Virginia, Minn. At the latter point auxiliary power is being used to generate electricity. The St. Louis River, on which the Fond du Lac (Minn.) dam is built, is also low, but not to so great an extent.

Officials of the Minnesota Power & Light Company have been stressing the point that its plants and transmission lines are so planned as to enable it to take care of any condition such as now exists. Thus by the transfer of power from one section to another scarcity of water power at one point is overcome by a surplus elsewhere. The low-water levels in the Mississippi River basin, into which the company's lines go, is attributed to lack of rainfall for several years. Since 1918 the rainfall has been so deficient as to cause a lowering of all water levels. This low water is not in any way hampering the service of the company, and if the extension of the electrical business is any barometer of conditions generally in the district the company serves, there is no trade depression over northern and central Minnesota, in the opinion of W. S. Robertson, manager of the company.

Famous Inventor Starts up Cleveland's New Station



CHARLES F. BRUSH, who invented the Brush arc lamp 48 years ago, is shown here starting up the new power plant of the Cleveland Electric Illuminating Company near Avon, Ohio, on Aug. 4. This 35,000-kw. unit is the first of a number which will ultimately make the rating of the plant 300,000 kw. At Mr. Brush's right stands William McClellan, consulting engineer and former president of the American Institute of Electrical Engineers. To the right of Mr. McClellan is James Parmelee of Cleveland, who with Myron T. Herrick originally financed the electrical industry in that city. Many other well-known electrical men are in the gathering.

Hydro Plants in Washington Interest Civil Engineers

Hydro-electric plants in the Northwest and the general power situation of that region were the main subjects dealt with at the session of the Power Division of the American Society of Civil Engineers at a recent summer meeting in Seattle.

The present power situation in Washington was reviewed by Prof. C. W. Harris of the University of Washington, who stressed the importance of the small hydro-electric development. The details of the design and construction of the Lake Cushman development were presented by J. L. Stannard, chief engineer of the project, and the Chelan hydro development was described by Victor H. Greisser, chief engineer Washington Water Power Company. A comparison made by W. D. Shannon, general superintendent Puget Sound Power & Light Company, between the Lake Cushman and Baker River projects showed many points of similarity. Further development of three power sites on the Skagit River by the city of Seattle was dealt with by Joseph Jacobs, consulting engineer of that city.

Of particular interest was a moving picture of the experimental arch dam built by Engineering Foundation on Stevenson Creek in California. H. W. Dennis, construction engineer Southern California Edison Company, explained the pictures as they were shown.

Program of Camp Co-operation VI Is Now in Shape

The business program for Camp Co-operation VI, which will be held at Association Island, Henderson Harbor, N. Y., Sept. 1-4 next, has been drawn up by the League Council in co-operation with the Society for Electrical Development. J. E. North, president of the Electrical League of Cleveland, is chairman of the program committee and will be responsible for selecting the speakers from the various leagues to present papers on special subjects. F. M. Feiker will preside over the business sessions.

Prior to the opening of the conference there will be special meetings on Aug. 30 and 31 of the members of the League Council and of officers and secretary-managers of leagues licensed to operate the "red seal" plan, a joint session of the League Council with secretary-managers of leagues, a meeting of individual members of the society who attend the conference and a meeting of the advisory publicity council of the Society for Electrical Development.

The flag-raising address at the opening ceremonies on Wednesday morning, Sept. 1, will be made by J. Robert Crouse, the father of the society, and will be followed by an address of welcome by President W. W. Freeman. On Wednesday evening there will be talks by leaders in the industry, to be followed by reports from several leagues on outstanding activities undertaken during the past year.

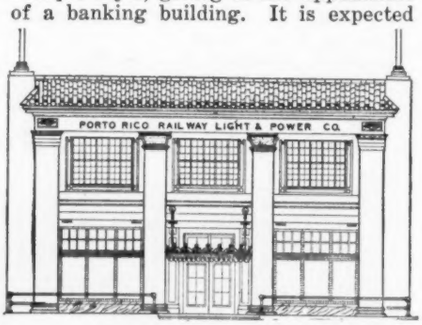
On Thursday morning the subjects will include national activities by commodities — refrigeration, lighting, delivery and industrial truck, etc. The talks will show the evolution of the co-operative method in promoting the electrical idea. A report of the League Council by J. E. North will be followed by a presentation of the national market development program by W. L. Goodwin. Thursday evening will be the women's session, featuring the part that women can take in league work.

On Friday morning the program is to be devoted to wiring subjects: (a) Summary of the progress of the "red seal" plan to date; (b) progress reports by licensed leagues; (c) wiring activities for commercial and industrial buildings; (d) report on the uniform ordinance. In the evening, at a round-table session, several national activities will be presented in addition to a discussion of the legal aspects of league work, promoting industrial relations and other subjects.

On Saturday morning industrial activities will be covered and will include a report from the Electrical League of Cleveland and other leagues as to their special work in this connection. This will be followed by a summing up of the work of the conference, which will close on Saturday evening with the annual banquet, with Fred P. Vose, secretary of the National Electrical Credit Association, as toastmaster.

Briefer News

Porto Rico Company to Erect Office Building.—The Porto Rico Railway, Light & Power Company, San Juan, is asking bids for a concrete office building, 75 ft. x 200 ft., two stories and basement, the front to be decorated with four massive columns and trimmed antique style, giving it the appearance of a banking building. It is expected



that the building, which will be on Santuree, a prominent street, will be ready for occupancy within six to eight months. It will cost about $75,000 and will supersede an outgrown wooden structure on the Marina. A tracing of the front elevation is reproduced.

Pasadena Municipal Plant Seeks Natural Gas as Fuel.—Bids are now being sought by the city of Pasadena, Cal., for a natural-gas supply to generate electricity at the municipal light and power department plant. Under the contract which the city has with the Los Angeles Gas & Electric Corporation Pasadena enjoys a rate of 19 cents per 1,000 cu. ft. of gas. This, according to Benjamin F. Delanty, general manager of the municipal light and power department, is equal to oil at $1 a barrel.

Rochester Company Prepares to Utilize Waste Waters of Canal.—Preliminary work has started on the new power dam in the Genesee River at Court Street, Rochester, N. Y., for the Rochester Gas & Electric Corporation. This dam will conserve waste water from the Barge Canal, for which a yearly rental will be paid the state.

Indiana Company Opposes Public Street-Lighting Plant at Marion.—City officials of Marion, Ind., are seeking to make space in the city's waterworks plant for two oil engines by means of which the city purposes to generate energy for lighting the streets. The Indiana General Service Company, which now supplies this service under contract, has asked a court injunction to prevent the city proceeding with its plans, asserting that no certificate of convenience and necessity has been issued by the Public Service Commission.

Rural Electrification in Kansas.—Farm leaders of Kansas and others interested in rural electrification will have visual evidence of progress being made when they gather at Larned, in that state, for the fall meeting of the Kansas Committee on the Relation of Electricity to Agriculture. The meeting probably will be held in October. Larned has been selected for the conference because it has been the seat of operations carried on in seven experimental farm projects in that vicinity. Meetings of the committee heretofore have been held at Manhattan, home of the state agricultural college.

Nebraska Section Will Have Another Commercial Camp School.—A commercial camp school under the auspices of the Nebraska Section of the National Electric Light Association has been arranged for by the executive committee, to be held at Camp Strader, near Crete, for four days beginning Aug. 26. A similar school was held at Grand Island in 1925 and was accounted a great success both in accomplishments and in the economy of time and space. Each person in attendance will pay a registration fee of $10. Short sessions will be held every forenoon, afternoon and evening. Experts will be present to discuss advertising, sales and commercial subjects, and the courses will be outlined so as to cover electric cooking the first day, illumination the second and refrigeration the third.

Litigation Over Merger in Missouri.—A suit is now pending in the Henry County (Mo.) Circuit Court to compel the stockholders of the West Missouri Power Company of Pleasant Hill to carry out an agreement to sell the physical property and common stock of the company to the Missouri Power & Light Company of Mexico, Mo. Stock holders of the company first named recently sought through the Public Service Commission to block the plans of the Missouri Power & Light Company to issue $335,000 in preferred stock to be applied on the purchase of the West Missouri company. The commission reduced the proposed issue by half. The protestants asserted that the Missouri Power & Light Company, which is a

subsidiary of the North American Light & Power Corporation, is overcapitalized and that its earnings are not sufficient to pay existing fixed charges and provide an adequate depreciation reserve.

Rocky Mountain Section, N.E.L.A., Convention.—From Sept. 13 to Sept. 16, inclusive, has definitely been chosen as the date for the joint annual convention of the Colorado Public Service Association and the Rocky Mountain Division, N.E.L.A. As in past years, the convention will be held at Glenwood Springs.

Mayor of Denver Presents "Red Seal" Certificate.—Declaring that the beginning of a "new era in house construction and home comfort and convenience" was in sight, Mayor B. F. Stapleton of Denver recently awarded a "red seal" certificate, emblematic of high-class wiring, to Walter H. Simon, a local architect. The award was made during the weekly meeting of the advisory board of the Electrical League of Colorado. Mr. Simon is the first home owner in Denver to receive the certificate. Fire Chief J. F. Healy complimented the Electrical League on getting behind this movement, which he said constituted insurance against fire.

Water Flow Very Low in Nebraska.—Low water in the Nebraska rivers is causing embarrassment to lighting plants that place their main dependence on water power. In the Blue River the flow is 60 per cent below normal. This has not affected the Nebraska Gas & Electric Company's operation, as that company uses water-power plants only as auxiliaries. The Gage County Electric Company, which has a development at Blue Springs, was forced to call upon the city of Wymore, which it supplies with energy, to start its municipal steam plant. At Beatrice, which it also supplies, the company has an oil-engine standby plant that it called into service. President Carl Schaeffer says that recently completed financing will enable the company to supply all the standby equipment it needs in the near future.

Major Edgerton Reports on Swiss Hydraulic Power Exposition.—Major Glenn E. Edgerton, chief engineer of the Federal Power Commission, has returned from a trip to Europe, where he visited the Exhibition for International Navigation and Utilization of Hydraulic Power at Basle, Switzerland. The exhibition, Major Edgerton says, calls attention in a striking way to the extent to which the Europeans already utilize the power resources and the navigation possibilities of their rivers and to the comprehensive programs which have been formulated for further development. The Europeans are not resting on their present high degree of development, but are bringing in new water power, deepening channels and expanding inland waterway terminals. Major Edgerton reports that positions of particular prominence have been given the exhibits of the Federal Power Commission and of the United States Geological Survey.

Central-Station Sales Managers Convene at Association Island.—Attended by representatives from Greater New York, Cleveland, Pittsburgh, Philadelphia, Buffalo and Boston, the fifteenth annual convention of the Sales Managers' Association of the Central Station Companies was held at Association Island, Henderson Harbor, N. Y., on Aug. 2, 3 and 4. A wide variety of papers covering every phase of the commercial problems confronting the electrical industry was presented by the delegates at the morning and evening sessions of the convention, which was under the chairmanship of G. E. Miller, sales manager of the Cleveland Electric Illuminating Company. Charles A. Barton, general sales manager of the New York & Queens Electric Light & Power Company, was appointed chairman for the new year.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 3, page 50.]

Association of Electragists International—Hotel Breakers, Cedar Point, Ohio, Aug. 24-27. L. W. Davis, 15 West 37th St., New York.

Camp Co-operation VI (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 1-4. (Society for Electrical Development, New York, is sponsor.)

Wisconsin Utilities Association, Electric Section—Eau Claire, Wis., Sept. 3 and 4. J. N. Cadby, 445 Washington Bldg., Madison, Wis.

American Institute of Electrical Engineers — Pacific Coast convention, Hotel Utah, Salt Lake City, Sept. 6-9. F. L. Hutchinson, 33 West 39th St., New York.

Illuminating Engineering Society — Essex and Sussex Hotel, Spring Lake, N. J., Sept. 7-10. L. H. Graves, 31 West 46th St., New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 13-16. O. A. Weller, Public Service Co., Denver.

New England Division, N. E. L. A.—Poland Spring House, Poland, Me., Sept. 20-23. Miss O. A. Bursiel, 149 Tremont St., Boston.

International Association of Municipal Electricians — Battery Park Hotel, Asheville, N. C., Sept. 21-24. E. H. Benz, West New York, N. J.

Great Lakes Division, N. E. L. A.—French Lick, Ind., Sept. 23-25. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Wisconsin Chapter, Western Section International Association of Electrical Inspectors—Milwaukee, Sept. 27 and 28. Harvey Griem, City Hall, West Allis, Wis.

Association of Edison Illuminating Companies — Chateau Frontenac, Quebec, Sept. 27-Oct. 1. P. S. Millar, 80th St. and East End Ave., New York.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 1 and 2, A. Bliss McCrum, secretary.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 4 and 5. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Cleveland, Oct. 4-8. J. W. Welsh, 292 Madison Ave., New York.

American Electrochemical Society — Hotel Washington, Washington, Oct. 7-9. C. G. Fink, Columbia University, New York.

North Atlantic Section, American Society of Agricultural Engineers—State College, Pa., Oct. 11-13—R. T. Wagner, 1 River Road, Schenectady, N. Y.

Kansas Section, N. E. L. A.—Manhattan, Kan., Oct. 14-16. H. Lee Jones, 401 National Reserve Bldg., Topeka, Kan.

Electrical Supply Jobbers' Association — Atlantic City, Oct. 18-22. F. Overbagh, 411 South Clinton St., Chicago.

Electric Power Club—Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 25-28. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Three Fuels Available for New McAlester (Okla.) Power Station.—Oil, gas or coal, either separately or in combination, may be burned under the boilers of the Southwest Power Company's 8,500-kw. initial plant at McAlester, Okla., just completed. The reason for the unusual combination is the fact that McAlester has an excess supply of natural gas, containing approximately 1,000 B.t.u.'s per cubic foot. However, when burning gas there are times when the supply is interrupted and it is necessary to have oil constantly available to pick up the load. The station is complete with automatic coal-handling equipment and overhead steel bunkers which deliver the coal by gravity to the pulverizers, making the operating labor very little more when burning coal than when burning either of the other fuels.

Large Hydro-Electric Plant at Buggs Island, Va., Is Prophesied.—Southern Virginia and nothern North Carolina are interested in reports that a long-talked-of hydro-electric plant on the Roanoke River is now assured as soon as a sufficient demand for power is manifest. The announcement is made positively by a Richmond attorney who has been instrumental in obtaining options at Buggs Island, Va., just across the North Carolina line. According to him the dam will be 53 ft. high and 1,500 ft. long, 15,000 acres will be flooded, 50,000 hp. developed, and electricity will be furnished to territory, mainly in North Carolina, which is not now served. No information as to the company or financial interests involved was vouchsafed by this spokesman, who admitted that the project is not one for the immediate future; but a preliminary permit for such a development was granted to the Roanoke River Power Company by the Federal Power Commission last March, the primary power being put at 9,500 hp.

Renewed Drought in South Carolina.—In commenting last week on the starting of the second unit at the Parr Shoals steam station of the Broad River Power Company, W. S. Barstow, president of the General Gas & Electric Corporation, controlling the Broad River property, said that the lack of rain this year already has made itself generally felt in hydro-electric operation in South Carolina. It is just a year ago that operations started at the Parr Shoals steam station, when low water through the South had curtailed hydro-electric operation, and power from that source relieved many industries in the Piedmont section from the necessity of either slowing down or entirely shutting down their plants. The second unit, which is rated at 30,000 kw. and will generate energy for use in territory extending from Columbia, S. C., to Spartanburg and to Henderson, N. C., will, like the first, a 12,500-kw. machine, burn powdered coal. Ultimately the plant will have a capacity of 65,000 kw.

Men of the Industry

G. R. Jones Promoted to a Vice-Presidency

George R. Jones, since 1919 secretary and treasurer of the Public Service Company of Northern Illinois, was elected vice-president in charge of purchases and stores by the board of directors of the company in session at Chicago Aug. 6. Concurrent with his appointment as vice-president of purchases and stores, he resigned the office of secretary, but retains title as treasurer in addition to the vice-presidency. **Joseph W. Kehoe**, assistant secretary and assistant treasurer, was elected secretary to replace Mr. Jones, but also retains his former title of assistant treasurer.

Mr. Jones' association with the Public Service Company and its predecessors dates back to 1909, when he entered the service of the North Shore Electric Company in charge of merchandise sales, subsequently taking charge of the company's purchases and stores. After the absorption of the company by the Public Service Company in 1911 he became purchasing agent of the new organization. His assignment as assistant to Vice-president John H. Gulick in charge of finance in 1919 was soon followed by his appointment as secretary and treasurer.

John B. Gough, formerly chief engineer for the Newfoundland Power & Paper Company, Ltd., at Cornerbrook, Newfoundland, is now designing engineer for Price & Company, Ltd., Quebec.

A. P. Gale, formerly director of public relations of the Wisconsin Power & Light Company at Madison, has been appointed division manager at Beloit to succeed the late Thomas F. Keefe.

E. B. Samp, local manager of the Dakota Public Service Company at Canova, S. D., since that utility took over the electric light plant, has been transferred by the company to Chamberlain, where he will be manager of the electric plant of the company in that city. **John Wagner** of Howard has been appointed successor to Mr. Samp as manager of the Canova system.

Thomas E. Davison has been appointed superintendent of transmission lines of the Adirondack Power & Light Corporation to succeed E. E. Lyford, resigned. Mr. Davison has had a wide experience in engineering work, having been a member of the civil engineering staff of the Adirondack Power & Light Corporation for the past five years. Prior to that association he held engineering positions with the Central Maine Power Company of Augusta and with the Consumers Power Company of Jackson, Mich.

A. P. Huested, formerly superintendent of the East Creek hydro stations for the Adirondack Power & Light Corporation, has been appointed superintendent of water-power plants to fill the vacancy left by the resignation of T. F. Malone. Mr. Huested is a native of Albany, N. Y., and a graduate of Tufts College in electrical engineering, class of 1901. Following graduation he took up construction work with the Westinghouse Electric & Manufacturing Company, which was at that time installing the electrical equipment in the plant of the Ontario Power Company, and continued in the operation of their plants for fifteen years. Mr. Huested was affiliated with the Niagara Falls Power Company for two years before affiliating himself with the Adirondack utility.

E. S. Bloom Elected President of Western Electric Company

Edgar S. Bloom, a vice-president of the American Telephone & Telegraph Company, was on Aug. 6 elected president of the Western Electric Company, succeeding Charles G. Du Bois, who

E. S. BLOOM

had been president for the past seven years and who continues with the company as chairman of the board of directors. The company's increasing activities and his variable health led Mr. Du Bois to ask to be relieved of part of his responsibilities.

Mr. Bloom is a graduate of the engineering department of the University of Pennsylvania, where he also took a post-graduate course. Starting in the engineering department of the New York Telephone Company, he has had a wide experience in engineering, construction, commercial and executive capacities with several of the associated companies of the Bell system. Before becoming vice-president of the American Telephone & Telegraph Company, a position which he now resigns, he was chairman of the board of directors of the Indiana Bell and Ohio Bell Telephone Companies and vice-president of the Illinois Bell Telephone Company.

Proctor L. Dougherty, an engineer, has been named by President Coolidge a commissioner for the District of Columbia. Executive authority in the District is vested in three commissioners. Mr. Dougherty was graduated from the Massachusetts Institute of Technology in 1897, where he took the course in electrical engineering. Immediately thereafter he joined the staff of the supervising architect of the Treasury Department, who has supervision over all public buildings, as an electrical engineer. Later he became assistant inspector of electric light plants, from which position he was promoted to that of inspector. In that capacity he had supervision over the operation of all electric light and power plants in the larger federal buildings throughout the United States. In 1910 Mr. Dougherty left the government service to join the technical staff of the Otis Elevator Company. Mr. Dougherty is a member of the Washington Society of Engineers and when engaged in engineering work was active in the American Institute of Electrical Engineers and American Society of Mechanical Engineers.

George A. Johns, manager of the Central Power Company at Central City, Neb., has been transferred to the Ravenna district as manager.

T. V. K. Swift, formerly local district superintendent of the Central Hudson Gas & Electric Company at Poughkeepsie, N. Y., is now affiliated with the engineering department as mechanical engineer.

L. N. Robinson of the engineering department of Stone & Webster, division of construction and engineering, has left Seattle to enter the engineering department of that company's Boston organization. For the past three years Mr. Robinson has been engaged in the development of the Puget Sound Power & Light Company's Baker River project.

J. B. McClure, district superintendent of the Visalia district of the Southern California Edison Company, has been transferred to Covina to succeed Walter Houseworth, who has been named district superintendent in San Bernardino, and **James A. Anderson**, district superintendent of Hanford, will replace Mr. McClure. **Glenn Luther**, assistant district superintendent in the Compton district, has been assigned to Hanford as district superintendent.

Frederic H. Hill, vice-president and general manager of the Elmira (N. Y.) Water, Light & Railroad Company, has been elected a member of the board of directors of the Chemung Canal Trust Company to succeed the late Fred D. Herrick. For several years Mr. Hill has taken active interest in the affairs of the community, being a leader in civic activities and organizations as well as prominent in important Elmira industries. He became chief engineer of the Elmira Water, Light & Railroad Company in 1913, later was promoted to be general manager and in 1918 was elected to the vice-presidency. He is also a director in several other public utility companies.

W. E. Houghton, for many years comptroller of the Los Angeles Gas & Electric Corporation, was chosen third vice-president and treasurer of the company at the regular meeting of the board of directors held July 28. In his new office Mr. Houghton will have charge of the general financing and accounting for the corporation. He is succeeding the late C. A. Luckenbach. **H. L. Masser**, gas engineer for the

company, was elected to fill the vacancy on the board of directors. He will continue to serve the company in his present capacity as gas engineer. Mr. Masser was formerly on the engineering staff of the California State Railroad Commission and is recognized as one of the foremost utility engineers in the country.

P. J. Logue, formerly resident engineer of the Central Hudson Gas & Electric Company at Goshen, N. Y., is now connected with the W. S. Barstow Management Corporation.

S. D. H. Pope, who had been connected with the electrical engineering department of the British Columbia Electric Railway Company, Vancouver, B. C., has resigned to become assistant engineer with the South Vancouver municipality.

George T. Medforth, managing engineer Canada Electric Company, Amherst, Nova Scotia, has been appointed by the provincial government a member of the executive council of the Association of Professional Engineers of Nova Scotia for a term of six months ending Dec. 31, 1926.

C. N. Clark, who has been connected with the station engineering department of the Kansas City (Mo.) Power & Light Company, has resigned to enter the engineering department of the Philadelphia Company. Mr. Clark has been connected with the Kansas City utility for the past two and a half years.

Paul Bailey, Deputy State Engineer of California since 1921, has been appointed State Engineer to succeed W. F. McClure, deceased. By this appointment Mr. Bailey also becomes ex-officio chief of the division of engineering and irrigation and director of the department of public works.

C. R. Gould has been appointed general manager of the Standard Turbine Corporation, Scio, N. Y. Mr. Gould has been identified with turbine manufacture for the past twenty years. His most recent connection has been with the Kerr Turbine Company, he having served that organization in the capacity of purchasing agent, treasurer and secretary.

B. Tikhonovitch, who has been connected with the engineering department of the New York Edison Company, was recently transferred to the electrical engineering department as assistant to the designing engineer. Mr. Tikhonovitch has served on the generating station committee and other committees of the American Institute of Electrical Engineers.

P. J. Stevenson has joined the Penn Public Service Corporation as power engineer. Though not working directly for the company, Mr. Stevenson has been associated with it through various engineering jobs and has built up a wide acquaintanceship in the Philipsburg, Clearfield and Johnstown districts. He is a graduate of Pennsylvania State College.

Harris E. Dexter of New York has been appointed chief of the electrical equipment division of the Department of Commerce to succeed R. A. Lundquist, who recently resigned to enter private employ. Mr. Dexter is a graduate of the Massachusetts Institute of Technology. He has had engineering and sales experience with the General Electric Company and the Boston Edison Company. For four years following the war he was in charge of the South China area for an American exporting firm. More recently he has been manager of the commercial division of the Service Corporation of New York.

W. E. Swartz of Dunnville, Ontario, has been appointed manager of the hydro-electric system at Petrolia, in that province.

Henry Trumbull, a director of the Trumbull Electric Manufacturing Company, Plainville, Conn., was recently elected second vice-president of the Connecticut Chamber of Commerce.

F. C. Jones has been appointed distribution engineer of the Consumers Power Company at Battle Creek, Mich. Mr. Jones has been transferred to the distribution department from the construction department.

Frank I. Bowler, formerly connected with the Central Hudson Gas & Electric Company at Poughkeepsie, N. Y., has been transferred to Newburgh in the capacity of district engineer.

Ernest Anderson, formerly auditor of the United Power & Light Corporation, Abilene, Kan., has been appointed general auditor of the Kansas Power & Light Company, Topeka, to succeed the late W. D. Cole.

R. V. Worthington, formerly manager of the Central Iowa Power & Light Company at Clarion, Iowa, has been appointed manager for the company at Emmetsburg, Iowa, to succeed R. E. Greengo, resigned.

F. E. Weymouth has severed his connection with Brock & Weymouth, Inc., as active head, although he remains a director and consultant of the company, and has been engaged by the J. G. White Engineering Corporation as chief engineer for work in Mexico.

G. H. Whyte, of the Calgary branch of the Dominion Water Power & Reclamation Service, has been appointed assistant district chief engineer of the British Columbia and Yukon branch of the service, with headquarters in Vancouver, B. C.

Walter Houseworth, for the past four years district superintendent of the Covina district of the Southern California Edison Company, has been transferred to the San Bernardino district in the same capacity. **Charles Harkelrath,** for many years district superintendent in San Bernardino, will soon retire, having completed 25 years of service with the Edison company.

E. L. Hughes, for several years assistant superintendent of the electric department of the De Sabla division of the Pacific Gas & Electric Company, has been transferred to the San Francisco office, where he will assume new duties in the electric construction and operating department. **W. G. Whitney,** formerly connected with the department of electric construction and operation, has been appointed to succeed Mr. Hughes.

Roy Worth, assistant district manager of the Pacific States Electric Company, San Francisco, has resigned his position with that organization. Mr. Worth has been connected with the electrical supply jobbing business on the Pacific Coast for the past eighteen years. Most of that time was spent in the Northwest, where he served as district manager for the Pacific States company before his transfer to San Francisco three years ago. Mr. Worth is leaving San Francisco to look after personal business interests in the southern part of the state.

R. P. Russel has been appointed assistant sales manager of the Oswego territory of the People's Gas & Electric Company of Oswego, N. Y.

George B. Sanford, formerly division manager at Sacramento, Cal., for the Great Western Power Company, San Francisco, has been appointed secretary and assistant treasurer of the Gray's Harbor Railway & Light Company, Aberdeen, Wash., succeeding A. B. Doerr, resigned.

Obituary

Carl von der Herberg, a German authority on electric cable manufacture, died recently at Mulheim, Germany, in his sixty-fourth year. He was a director of the Felten & Guilleaume Carlswerke Gesellschaft of that city and had been associated with the organization for 37 years.

Joseph Rogers, president of the Rogers Electric Company, Toronto, Ont., died at his home in that city on July 12, following a short illness. Mr. Rogers was born in Simcoe County, Ontario, but at an early age removed to London, Ont., where he founded the business of which he was head. In 1899 he transferred his interests to Toronto and became prominent there through his business and fraternal connections.

A. Wellington Hillis, secretary and treasurer of the Electrical Products Company, died recently at his home in Detroit, Mich. Mr. Hillis was prominent in electrical engineering circles. From 1905 until the beginning of the World War he was connected with the Western Electric Company, which position he resigned to take over the purchasing of electrical supplies for the United States government at Nitro, W. Va. In 1924 he with A. R. Morey formed the Electrical Products Company.

Charles D. Jenney, formerly manufacturer of electrical equipment in Indianapolis, died at his home in that city May 8. Mr. Jenney entered upon his career in the electrical industry at Ann Arbor, Mich., when he was only seventeen years of age, later removing to Detroit. The year 1882 found him in Fort Wayne, Ind., as the organizer of the Fort Wayne Jenney Electric Company, which is now a branch of the General Electric Company. It was in 1885 that Mr. Jenney shifted his interests to Indianapolis. With Addison Nordyke, Amos K. Hollowell and Daniel M. Marmon he formed the Jenney Electric Motor Company, manufacturer of arc lights, motors and generators. He removed his plant to Anderson, Ind., in 1910. Mr. Jenney was born at Flint, Mich., Feb. 28, 1864.

Commission Rulings

Consolidation of Scattered Companies in Growing Territory Commended.—Approving the application of various small independent light and power companies for permission to merge with the Harlem Valley Electric Corporation, the New York Public Service Commission said: "The territory in which these companies operate is a growing one and offers excellent opportunities for the extension of the light and power business. This is a good reason for a correlation of these many independent operating companies, as the advantage of one direct and strong management over all of them is obvious." The original cost of construction was held to be a satisfactory basis for the purchasing company to take over the fixed assets of the consolidating concerns.

Present-Day Reasonable Rate of Return—Going Value.—An indication of the policy to be followed by the Missouri Public Service Commission in passing on the valuation of property of the Laclede Gas Light Company and the United Railways Company of St. Louis in cases now pending before it is given in an order recently issued fixing the valuation of the Jackson County Light, Heat & Power Company of Independence, in which an allowance of 7.5 per cent was made for going value. The commission also reasserted previous rulings that approximately 7 per cent is a reasonable rate of return. In the Jackson County case the commission said: "A reasonable rate of return at this time lies within a minimum of 7 per cent and a maximum of 8 per cent." The receiver of the United Railways Company has requested that that company be permitted to earn 8 per cent on its valuation for rate-making purposes. In the Laclede Gas case, now under submission for final decision and strongly contested, the company has contended for a valuation of $74,795,000 based on reproduction new at present-day prices less depreciation. This figure includes $12,137,219 for going value, or 16.2 per cent of the total valuation claimed. In determining public utility valuations the commission has rarely allowed in excess of 10 per cent for going value.

Opposes Financing of Extensions by Preferred-Stock Issues.—The Missouri Public Service Commission has, as stated elsewhere in this issue, made an order reducing by one-half a proposed preferred-stock issue of $335,000 by the Missouri Power & Light Company of Mexico and ruling that the balance should be raised through the sale of common stock, indicating in this way disapproval of public utilities' financing expansions and absorptions through the issuance of preferred stock without a corresponding increase in the common or voting stock. In many such cases the purchasing companies have acquired the common stock only of the utilities taken over, permitting the former owners to retain the preferred stock. Application would then be made to the commission for authority to issue bonds or preferred stock to reimburse the treasury of the purchasing company. In the case of the Missouri Power & Light Company it was sought to issue the $335,000 in preferred stock to help finance the purchase of the West Missouri Power Company of Pleasant Hill. The capital liabilities of the Missouri Power & Light Company, the commission found, totaled $10,157,012, including $6,500,000 in bonds, $2,865,000 in preferred stock and $1,056,297 in common stock, and in addition $95,715 in payments on subscriptions for preferred stock. Thus the common stock was approximately 10 per cent of the total capitalization. The commission evinced a tendency to require controlling companies in future to put more of their own money into extensions and improvements.

Recent Court Decisions

De Forest Wins Suit for Infringement of "Feed-Back" Radio Patent.—The United States District Court for the Eastern District of Pennsylvania has found for the plaintiff in De Forest Radio Telephone & Telegraph Company vs. Westinghouse Electric & Manufacturing Company, a radio patent suit. This was a final hearing upon bill, answer and proofs concerning alleged infringement of the plaintiff's patents on the so-called "feed-back" or "regenerative" circuit arrangement employed with a three-electrode vacuum tube. The question of priority as between the De Forest and the Armstrong patents was at issue, and the effect of conflicting decrees of the District Court for the Southern District of New York, affirmed by the Circuit Court of Appeals of the Second Circuit, and of the Court of Appeals of the District of Columbia was squarely raised. The two courts first named sustained the Armstrong claims, and the defendant maintained that the question was therefore *res adjudicata* and could not be reopened. The court in Pennsylvania refused to accept this view, holding that these decrees were interlocutory in nature and that the decision of the Court of Appeals of the District of Columbia must control unless additional testimony carried conviction that that court was in error. After analysis of such testimony the Pennsylvania court held that this was not the case and declared that De Forest was the first and original inventor of the feed-back circuit and the oscillating audion and that claims Nos. 1, 2, 3, 5, 8, 9, 12, 14, 15, 16, 17 and 18 of Armstrong patent No. 1,113,149 are invalid.

Watertown, N. Y., Wins in Case Charging It with Breach of Contract.—The city of Watertown, N. Y., has obtained the dismissal in the Supreme Court of New York of an action brought against it by the Northern New York Utilities to recover $192,256 for alleged breach of contract in refusing to purchase the company's street-lighting equipment at the price named. The complaint mentions two contracts for lighting the city, one made in 1915 for a five-year period and one entered into in 1921 for a period of three years. Since the expiration of the latter contract in 1924 the Utilities company has been lighting the city without contract. In the 1915 contract was a clause providing that if the city at any time after the expiration of the agreement should determine to do its own municipal lighting it would buy the company's poles, lines and other equipment of the street-lighting system. This pledge was not included in the 1921 contract, but the company held that the 1915 contract was not dead but in force along with that of 1921. The court held that the contracts were separate and complete in themselves and that the 1921 contract superseded that of 1915, the latter having been used only as a form for the new one. The company will appeal the case.

Man Killed by Electricity While Voluntarily Performing Act He Knew to Be Dangerous Guilty of Contributory Negligence.—A verdict for the defendant on the ground of the contributory negligence of a workman for whose death from electric shock damages were sought was sustained by the Supreme Court of Alabama in Childers vs. Samoset Cotton Mills. It was testified that the man killed had placed an iron bar near an electric motor in operation and had later sought to remove it and been killed by the high current with which the bar had become charged, and that the man knew the danger attendant on such an act. (108 So. 851.)*

Qualifications of Expert Witness in Electrical Case.—In Sinkovich vs. Bell Telephone Company of Philadelphia damages were awarded in the trial court because of the death of a man struck by lightning while standing in front of a window. The theory advanced was that lightning struck a telephone pole in front of the house and was conveyed from it to the victim over an unused wire, which, it was claimed, should have been removed by the telephone company. The Supreme Court of Maine reversed the case, finding that too much dependence had been placed on the testimony of a witness whose knowledge of electricity had been learned solely from experience as a workman and whose expressions of opinion on highly scientific subjects were, the court said, valueless. Leaving the wire on the pole did not constitute negligence, and it had not been shown that the lightning followed the wire to the house nor that the installation of a lightning arrester would have stopped it. Two qualified experts were of opinion that the man had been killed by a direct lightning stroke. The evidence, therefore, the Supreme Court held, was insufficient to justify sending the case to the jury. (133 At. 629.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Utility Market Improves

Moderate Gains Recorded, Principally in Over-the-Counter Trading of the Week

DURING the week ended Aug. 10 the speculative security markets gave a demonstration of strength in the industrial and railroad list that had not been witnessed since the March break. Under the powerful leadership of General Motors, which has added to its motor success that of Frigidaire, the market was lifted up to a position about on a level with the peak early in 1926. To date the power and light stocks have not shown the same degree of strength that has been demonstrated in the industrial and rail lists, but, on the other hand, the utilities have crept forward gradually and have revealed great stability.

The maximum gains for the week in the utility group were around four or five points. Advances of about that much were recorded by such issues as Consolidated Gas of Baltimore, Consolidated Gas (New York), Electric Investors, Inc., Northern States Power of Delaware class A, Galveston-Houston, General Gas & Electric class B and United Gas Improvement.

Smaller gains were registered by American Light & Traction, American Superpower classes A and B, Southeastern Power & Light, Commonwealth Power Corporation and several preferred issues.

The market in power and light bonds has undergone little fluctuation of late but has remained generally firm.

Narragansett Board Opposes Rhode Island Merger

In a statement addressed to stockholders, the board of directors of the Narragansett Electric Lighting Company expressed its disapproval of the plan outlined in the Aug. 7 issue of the ELECTRICAL WORLD covering the proposed consolidation of that utility with the United Electric Railways Company of Providence. The directors have stated their position in the following terms: (1) The plan was not proposed by the Narragansett company but came entirely from outside interests. The company first learned of the contents of the plan when the terms were made public on July 29. (2) Considering safety of principal and income yield, including value of rights, the directors believe that the stock of the company is intrinsically worth much more than the price offered under the plan—$86 per share. (3) None of the directors of the company is interested in the underwriting of the new securities proposed to be sold if the plan is carried out and none has deposited his stock.

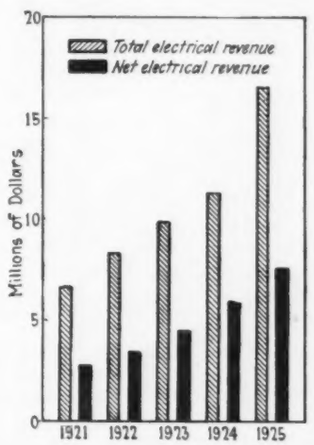
In addition, the statement included the following announcement to stockholders. "(a) If you deposit your stock, you lose your rights as stockholders and become entitled only to the rights given under the plan and agreement. (b) If you deposit your stock, it may be transferred immediately out of your name, and in any event you will not be entitled to vote it at the annual meeting next February, nor at any special stockholders' meeting prior to March 15, 1927, whether the plan is carried out or not, because the stock is not to be returned to you until on or after March 15, 1927. (c) If you deposit your stock, you cannot withdraw from the plan without the consent of the Service company unless the offer of $86 per share is reduced, and if the price is not reduced the plan may be modified or altered in any manner without notice to you. (d) The plan contains no definite date when the stock must be returned if the plan is abandoned. (e) The plan may be abandoned as to the United Electric Railways Company and become effective as to the Narragansett Electric Lighting Company, in which event it would become a plan solely to obtain control of the Narragansett company."

From time to time the directors will issue further statements discussing the plan if the situation requires.

Columbia Gas & Electric Company

Combined Gross Earnings of System Amounted to $44,242,285 in 1925—Capitalization of Companies Now Controlled By It

CHARTS, statistical tables and a map contained in the annual report of the Columbia Gas & Electric Company for the year 1925 present clearly the intercorporate relations, the capitalization of the constituent companies, the field of operations, and, by comparison with previous years, demonstrate the progress attained. Combined gross earnings of all companies of the Columbia system, including those substantially less than 100 per cent owned, although operated under the supervision of the Columbia Gas & Electric Company, and after elimination of all intercompany accounts, were $44,242,285 in 1925, and the net earnings on the same basis, but before reserving any amounts for depletion, replacements and renewals, amounted to $21,982,679. Gross earnings of the Columbia Gas & Electric Company and subsidiary companies, controlled by practically 100 per cent common-stock ownership or lease, totaled $33,483,559 in 1925 as compared with $26,727,581 in 1924, and operating expenses amounted to $19,678,261 in 1925 against $15,774,768 in 1924, leaving net earnings of $13,805,298 in 1925 as compared with $10,952,813 during the preceding year.



ELECTRICAL REVENUE OF COLUMBIA GAS & ELECTRIC SYSTEM

One of the features of the company's construction program during the year was the completion of the new station at Columbia Park, just west of Cincinnati, at the confluence of the Big Miami and Ohio Rivers. The principal features of the station are its coal-handling equipment, enabling it to receive coal both by river barge and by rail; its use of pulverized coal as a fuel; its use of steam at 600 lb. pressure, superheated to 750 deg. F., driving 26-stage turbines, directly connected to generating units of 45,000-kva. capacity. The installed electric generating capacity of the system at the close of 1925 was 368,000 kva.

The companies constituting the Columbia system had outstanding in the hands of the public as of Dec. 31, 1925, $223,916,040 par value of securities. Of the total amount 22 per cent consisted of mortgage bonds of subsidiary and leased companies, 34 per cent were preferred stocks of subsidiaries and capital stocks of leased companies, and 44 per cent were the outstanding securities of the Columbia Gas & Electric Company. Holders of the outstanding stocks of these companies at the end of the year numbered 33,600, an increase of 4,900 shareholders in twelve months. Approximately 20,600 shareholders, or 61 per cent of the total number, are residents of the territory served by the companies constituting the Columbia system.

Capital expenditures in 1925 for additions and extensions to properties of the Columbia system aggregated $21,355,289. Of this sum the Columbia

station absorbed $8,693,930; new high-voltage transmission lines and substations called for an expenditure of $2,432,627, properties of the Cincinnati Gas & Electric Company account for $2,870,538, and extensions and additions to the gas and electric distribution systems in Dayton cost $3,079,011. In addition a sum of $1,852,997 was spent on the other properties in Ohio, $244,387 on the properties of the Union Light, Heat & Power Company and the Cincinnati, Newport & Covington Railway Company, and $2,181,000 on the properties in West Virginia and on other properties in Kentucky.

Some electrical statistics are interesting to note. Total electrical revenues in 1925 amounted to $16,607,958 and operating expenses to $9,177,671, leaving net earnings of $7,430,287. These figures compare with $11,316,069 for total electrical revenues, $5,420,067 for operating expenses and $5,896,001 for net earnings in 1924. Total electrical customers at the close of 1925 amounted to 236,497, as compared with 144,182 in 1924. Total kilowatt-hours generated and purchased advanced from 487,030,985 in 1924 to 734,625,184 in 1925.

New Capital Issues

During the week ended Aug. 12 the North American Light & Power Company made an offering of sinking-fund gold debentures, series A, a piece of financing involving a total of $15,000,000. The North American Light and Power Company, incorporated under the laws of Delaware, controls the common stocks of the Illinois Power & Light Corporation, and the Missouri Power & Light Company, which directly or through subsidiaries serve 1,350,000 population in over 520 municipalities in Illinois, Iowa, Missouri, Kansas and Nebraska. These debentures, dated July 1, 1926, and maturing July 1, 1956, were priced at 94½ and accrued interest, to yield about 5.90 per cent. The proceeds from the sale of the debentures will be used to retire the entire issue of the notes of the company known as North American Light & Power Corporation 7 per cent secured notes and the preferred stock of the North American Light & Power Company (Maine), to furnish additional working capital, and for other purposes in connection with the financial reorganization of the company.

Short-term financing was done during the week under review by the Midland Utilities Company, which issued 5 per cent serial gold notes to the amount of $5,000,000. These notes, dated Aug. 1, 1926, and maturing serially from Nov. 1, 1929, to Nov. 1, 1931, were offered at prices ranging from 99½ to 98⅝ to yield from 5.17 to 5.30 per cent. These 5 per cent serial gold notes will be a direct obligation of the company and, with the 4½ per cent and 5 per cent serial gold notes totaling $3,000,000 now in the hands of the public, will constitute the only funded debt of the company to be presently outstanding. Proceeds are to be used to reimburse partially the company's treasury for funds used in the development of its subsidiary companies and for other corporate purposes.

Six per cent gold debentures of the Nevada-California Electric Corporation amounting to $3,000,000 were offered during the week at 99 and interest to yield about 6.10 per cent. These debentures were dated July 1, 1926, and mature July 1, 1941. Proceeds from this issue and from the sale of first trust mortgage gold bonds totaling $23,000,000 offered in June will be used to retire 6 per cent first lien series A bonds totaling $9,341,800 and 6 per cent first

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Aug. 10	Low 1926	High 1926
ABITIBI PWR. & PAPER, com.			
—no par	k 81½	70½	84½
Adirondack Pwr. & Lt.—7% pf.	107½	....	....
Adirondack Pwr. & Lt.—8% pf.	113	....	....
Ala. Pwr., pf.	105½	....	....
Allis-Chalmers Mfg. pf.	k110½	105	110½
Allis-Chalmers Mfg., com.	91	78½	94½
Aluminum Co. of Amer., com.	70½	54½	76
Aluminum Co. of Amer. new, pf.	101	....	....
Amer. & Foreign Pwr., pf 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	k 92	88½	98
Amer. & Foreign Pwr., com.—no par	21½	15½	42½
Amer. Bosch Magneto, com—no par	19½	16	34½
Amer. Brown, Boveri, Elec.	49½	30½	50
Amer. Brown, Boveri, Elec., pf.	96½	86½	97½
Amer. Elec. pwr., pf.	m111	102	111
Amer. Gas & Elec., 6% pf.—no par.	95	90½	95½
Amer. Gas & Elec., com.—no par.	97½	64	99½
Amer. Lt. & Trac., 6% pf.	108	105	115½
Amer. Lt. & Trac., com.	224	195	263
Amer. Pwr. & Lt., 6% pf.	96½	92	97
Amer. Pwr. & Lt., com.—no par.	69½	45	80
Amer. Pub. Serv., 7% pf.	a 97	92	99
Amer. Pub. Serv., com.	50	45	80
Amer. Pub. Utilities, 6% pf.	85	....	....
Amer. Pub. Utilities, 7% pf.	94	....	....
Amer. Pub. Utilities, com.	79	....	....
Amer. States Sec., A	3	....	....
Amer. States Sec. B	2½	....	....
Amer. Superpwr., pf.—25	k 25½	23	26½
Amer. Superpower, pf.	93	....	....
Amer. Superpwr., Class A—no par.	32	19½	37½
Amer. Superpwr., Class B—no par.	32½	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	k106	101½	108½
Amer. Wtr Wks. & Elec., com.—20	60½	43½	74
Anaconda Copper	51½	41½	51½
Appalachian Pwr., 7% pf.	98	99	101
Appalachian Pwr., 1st pf., 7%	98	99	102
Appalachian Pwr., com.	78	78	83
Arizona Pwr., 7% pf.	m 70	....	....
Arkansas Cent. Pwr., pf., $7—no par	k104	99	107
Arkansas Lt. & Pwr., 7% pf.	101	....	....
Arkansas Lt. & Pwr., com.	101½	102	103
Asheville Pwr. & Lt., 7% pf.	l105½	100½	107½
Assoc. G. & E., pf.—$3.50—50	50	....	....
Assoc. Gas & Elec., pf.—$6—no par	84	....	....
Assoc. Gas & Elec., Class A—no par	35	25½	35½
BABCOCK & WILCOX, com.	119	....	....
Birmingham Elec. pf.—$7—no par.	103½	....	....
Blackstone Valley Gas & Elec., pf.	103	103	106
Blackstone Valley G.&E., com.—50	99	....	....
Blaw-Knox, com.	i 59½	45	60½
Brazilian Trac., Lt. & Pwr., com.	f110½	....	....
Broad River Pwr., pf.	94	....	....
Brooklyn Edison, com.	151½	133	153
Buffalo, Niagara & East. Pwr., pf.—25.	24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	31½	....	....
CALIFORNIA ELEC. GENERATING, pf.	92½	89	95
California Ry. & Pwr., pf.	90	88	115
Carolina Pwr. & Lt., pf.—$7—no par	106½	....	....
Cent. & S. W. Ut. 7% pf.—no par	a 93	89½	96½
Cent. & S. W. Ut., pr. In. pf.—no par	a 96	93	100
Central Ariz. Lt. & Pwr., pf.	104	....	....
Central Ark. Ry. & Lt., 7% pf.	k 98	99	99½
Central Ill. Pub. Serv., 6% pf.	a 88½	87	91
Central Ind. Pwr., 7% pf.	85	85	93½
Central Pwr. & Lt., pf.	97½	....	....
Central States Elec., 7% pf.	91	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m115	110	116
Chicago Fuse Mfg., com., no par.	a 32	30	35
Cincinnati Gas & Elec., com.	g 90	88	95
Cities Service, 6% pf.	l 87½	82½	86½
Cities Service, pf. B—10.	l 7½	7½	7½
Cities Service, pf. BB—100.	l 79	74	79
Cities Service, com.—20.	l 42½	37½	42½
Cities Service, Bks. Shrs.—10.	l 21½	19½	20½
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	108	....	....
Cleveland Elec., Illg., com.	k295	240	310
Colorado Pwr., 7% pf.	k 95	96	97
Columbia Gas & Elec., 7% pf.	k115½	112	115½
Columbia Gas & E., com.—no par.	83½	63½	90
Columbia Ry., Gas & Elec., 6% pf.	90	65	96
Columbus Elec. & Pwr., 2d pf.	104	....	....
Columbus Elec. & Pwr., com.	250	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	99	....	....
Columbus Ry., Pwr. & Lt., pf. B.	93½	....	....
Col. Ry., Pwr. & Lt., com.—no par.	65	....	....
Commonwealth Edison, com.	a136½	135½	145
Commonwealth Pwr., 6% pf.	87	82	88½
Commonwealth Pwr., com—no par.	41½	28½	42½
Conn. Lt. & Pwr., 8% pf.	117	....	....
Conn. Lt. & Pwr., 7% pf.	109	....	....
Cons. Gas of N. Y., pf.—50.	59½	....	....
Cons. Gas of N.Y., com.—no par.	112½	87	115½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	k104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	e110½	108½	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e112½	109	113½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e127½	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 54½	45	57½
Cons. Pwr. & Lt., 7% pf.	104	....	....
Consumers Pwr., 6% pf.	98	....	....
Consumers Pwr., 6.6% pf.	104	....	....
Continental Gas & Elec., 7% pte. pf	101	....	....
Continental Gas & Elec., 7% pr. pf.	96	....	....
Continental G.&E., com.—no par.	140	....	....
Croker Wheeler, com.	19	....	....
Croker Wheeler, pf.	54	....	....
DALLAS PWR. & LT., 7% pf.	105½	....	....
Dayton Pwr. & Lt., 6% pf.	100	....	....
Detroit Edison, com.	136½	123½	141½
Dubilier Condenser & Radio, com.—no par.	5	4½	11
Dubuque Elec., 6% pf.	94	93	98½
Duquesne Lt., 7% pf.	k115½	111½	116½
EAST. N. Y. UTIL. pf.	102	80	104
Eastern New York Util., com.	65	70	75
Eastern States Power.	16	....	....
Eastern States Power, pf.	k 87	89	95
Eastern Tex. Elec., 7% pf.	103	....	....
East. Tex. Elec., com.—no par.	75	70	80
Edison Elec. Illum. of Boston, com.	d234½	207	250
E. Paso Elec., com.—no par.	70	70	94
E. Paso Elec. pf.	100	....	....
Elec. Bond & Share, 6% pf.	l108	103½	109½
E. Bd. & Share Sec., com.—no par.	l 73	56½	86
El. Household Util.	a 15	13½	25
Elec. Investors, 6% pf.—no par.	92	....	....
Elec. Investors, com.—no par.	47½	30½	74½
Elec. Investors, 10% pd. receipts	20	12	56
Elec. Pwr. & Lt., ctfs, pf.	97	89½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	k104½	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	m105½	....	....
Elec. Pwr. & Lt., ctfs., com—no par.	19½	15½	34½
Elec. Ry. Securities, com.—no par.	6	4½	10
Elec. Refrig.	66½	62½	78½
Elec. Storage Battery, com.—no par.	87½	71½	86½
Elmira Wtr., Lt. & R. R., 7% pf.	99	97½	99
Emerson Elec., pf.	b101	100	104½
Empire Dist. Elec., 6% pf.	88	82	88
Empire Power, A.	26½	21	32
Engr. Pub. Serv., pf.—no par.	m 96	87	96
Engr. Pub. Serv., com.—no par.	m 24	24	29½
Eureka Vac. Cleaner, com.—no par.	53½	43	56
FAIRBANKS MORSE, pf.	k100½	108½	115
Fairbanks Morse, com.—no par.	k 52½	46	59½
Federal Lt. & Trac., com.	33½	28	39½
Federal Light & Traction, pf.	k 88	86	89
Federal Utilities, pf.	70	....	....
Federal Utilities, com.	17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l106½	105	108½
GALVESTON-HOUSTON ELEC., 6% pf.	48½	42½	62
Galveston-Hstn. El., com.	17	14	21
Gen. Elec., com.	90	79	91½
Gen. Elec., special—10.	11½	11	11½
Gen. G.&E., (Del.) com. A no par.	50½	34	59
Gen. G.&E., (Del.) com. B no par.	46	28	46
Gen. G.&E., (Del.) A pf. $8 no par.	k106½	105½	110½
Gen. G.&E., (Del.) A pf. $7 no par.	k 97½	95	99½
Gen. G.&E., (Del.) pf. B.	k 93½	92½	96
General Public Service, pf.	m104	90	106½
General Public Service, com.	k 12½	12½	16½
Ga. Lt., Pwr., & Rys., 6% pf.	94	82	96
Ga. Lt., Pwr. & Rys., com.	70	65	81
Ga. Ry. & Power, 8% pf.	113	....	....
Ga. Ry. & Power, 7% pf.	103½	....	....
Ga. Ry. & Pwr., 4% pf.	k120	105	145
Ga. Ry. & Pwr., com.	120	....	....
Gt. Western Pwr., 7% pf.	h102	....	....
IDAHO PWR., 7% pf.	103	103½	104
Ill. No. Utilities, 6% pf.	a 91	90	92
Ill. Pwr. & Lt., 7% pf.	99	....	....
Ingersoll Rand.	▮ 91½	80½	105
Int. Combus. Engr., com.—no par	59½	33½	64½
Int. Utilities, class A—no par.	k 31½	31	39
Int. Utilities, class B—no par.	4½	4½	9½
Interstate Pwr., pf., no par.	92	....	....
Interstate Pub. Serv., 7% pf.	96	97	98
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT., 7% pf.	96	97½	99
Jersey Central Pwr. & Lt., ptc., pf.	108	94	113
Jersey Central Pwr. & Lt., com.—no par.	45	....	....
Johns-Manville, com.—no par.	152	120	165

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. Saturday, Aug. 7. lBid, low, high, Wednesday, Aug. 11. mLatest quotations available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Aug. 10	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf.	k109¼	107¼	112½
Kansas Gas & Elec., 7% pf.	l102	99	103
Kentucky Hydro-Elec., pf.	a 96	91½	99½
Kentucky Sec., 6% pf.	80	....	....
Kentucky Sec., com.	100	....	....
Kentucky Utilities, 6% pf.	a 52½	49	52
Keystone Pwr. & Lt. 7% pf.	96	95	97
LACLEDE GAS LT., com.	k166	146	175½
Lehigh Pwr. Sec., com.—no par.	17½	10	23
Long Island Ltg., 7% pf.	108	....	....
Long Island Ltg., com.—no par.	120	120	150
Los Angeles Gas & Elec., 6% pf.	96	....	....
Louisville Gas & Elec., Class. A	24½	....	....
MANHATTAN ELEC. SUPPLY.	87½	56	87½
Manila Elec., com.—no par.	35	27½	39½
Maytag Mfg., com.	23½	19	24½
Memphis Pwr. & Lt., pf., $7, no par	107	107½	108
Metro. Edison, pf.—$6—no par.	92½	....	....
Metropolitan Edison, pf., $7, no par.	103	....	....
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a107½	97½	111½
Middle West Utilities, 7% pr. lien pf.	a116½	106½	123½
Middle West Utilities, com.—no par.	a114½	108	134½
Midland Utilities, pr. ln. pf.	a102	98	104
Midland Utilities pf. A	a 99	96	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	101	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	93	....	....
Minn. Pwr. & Lt., 7% pf.	l102½	100	104
Miss. Pwr. & Lt., pf.	105	....	....
Miss. River Pwr., 6% pf.	95	....	....
Miss. River Pwr., com.	60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	103	103	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par	98	....	....
Mohawk Hudson Pwr., com.—no par	24½	20½	28½
Montana Pwr., pf.	m117½	112½	119½
Montana Pwr., com.	80½	69½	83½
Montreal Pwr., com.	f227½	....	....
Mountain States Pwr. pf.	97	....	....
Mountain States Pwr., com.	20	....	....
NASSAU & SUFFLOK, LTG., pf.	98	....	....
National Carbon, pf.	a126	125	128
National Elec. Pwr., pf.	a 95	92	96½
National Electric Pwr-A.	a 25	19½	26½
Nat. Lt., Ht. & Pwr., com.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	101	96	102½
National Pwr. & Lt., com.—no par.	22½	16½	38½
National Pub. Serv., 7% pf.	93	....	....
National Pub. Serv., pfc. pf.	110	96	112
National Pub. Serv., A com.—no par.	20½	15½	24
National Pub. Serv., B com.—no par.	16	10	17½
Nebraska Pwr., 7% pf.	l106½	103	107½
Nevada-Calif., Elec., com.	23½	18½	44½
New Brunswick Pwr., pf.	50	30	55
New England Pub. Serv., pr. ln. pf.	97	98	99½
New England Pub. Serv., pf.	89	95½	97
N. J. Pwr. & Lt., 7% pf.	104	104	110
New Orleans Pub. Serv., 7% pf.	102	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	87	....	....
N. Y. Central Elec., 7% pf.	99	100	101
Newport News & Hampton Ry., Gas & Elec., com.	109	98	112
Newport News & Hampton Ry., Gas & Elec., pf.	109	98	114
Niagara Falls Pwr., 7% pf.—25	c 28	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	109	110	111½
No. Amer., 6% pf.—50	k 51	49	51½
No. Amer., com.—10	55½	42	67
No. Amer. Edison pf.—no par.	95½	91½	96½
No. Amer. Lt. & Pwr., pf.	101	88	104
No. American Utilities, pf., full pd.	m 94½	89	96
No. American Utilities, pf., 25% pd.	m 19	18	27
N.C. Pub. Serv., pf.—$7—no par.	92½	....	....
Northeastern Pwr., com.	19½	17½	36½
No. Indiana Gas & Elec., pf. A	101	98	103
No. N. Y. Utilities, 7% pf.	104	....	....
No. Ohio Pwr.	14	11	26½
No. Ohio Trac. & Lt., 6% pf.	80	78	81
No. Ohio Trac. & Lt., 7% pf.	94	88	96
No. Ont. Lt. & Pwr., pf.	83	....	....
No. Ont. Lt. & Pwr., com.	73	45	75
No. States Pwr., 7% pf.	k102	100	101½
No. States Pwr. com.	106½	97	136½
No. Texas Elec., 6% pf.	48	....	....
No Texas Elec., com.	18	....	....
OHIO BRASS, com. B—no par	74	70	79
Ohio Brass, pf.	101	98	101
Ohio Gas & Elec., 7% pf.	94	92	95
Ohio Pwr., 6% pf.	95	95½	96
Ohio Pub. Serv., 6% pf.	l 94	90	96
Ohio Pub. Serv., 7% pf	l 99	96	100
Ohio River Edison, pf.	100½	...	...
Oklahoma Gas & Elec., pf.	95	....	....
PACIFIC GAS & ELEC., 6% pf.	100½	....	....
Pacific Gas & Elec. com.	129	118	132½
Pacific Pwr. & Lt., 7% pf.	l101	90	102½
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt & Pwr., pf.—no par	c 72	71	91
Penn-Ohio Edison, 7% pf.	96½	....	....
Penn-Ohio Elec., 7% pf.	95	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	95½	94	97
Penn-Ohio Pwr. & Lt., 8% pf.	106	106½	108
Penn Pwr. & Lt.—$7—no par.	l106½	103	108½
Penn Pub. Serv., 7% pf.	101	96	103
Penn Pub. Serv., 6% pf.	85	85	90
Penn Wtr. & Pwr., com.	c 150	141	171
Phila. Co., 6% pf.—50	c 49½	48½	50½
Phila. Co., com.—50	k 70	59½	76½
Phila. Elec., com.—25	c 51½	41½	67½
Pittsburgh Utilities, pf.—10	m 17	14½	20½
Portland Elec. Pwr., 7% pf.	101	....	....
Portland Elec. Pwr., 6% pf.	84	....	....
Portland Elec. Pwr., 6% 2nd pf.	73	....	....
Portland Elec. Pwr., com.	32	....	....
Potomac Elec. Pwr., pf.	f108	....	....
Pwr. Corp. of N.Y., com—no par.	m 79	77½	90½
Pwr. Sec., pf.—no par.	k 10	10	29
Pwr. Sec., com.—no par.	k 4	4	13
Pub. Serv. of N. J., 7% pf.	k106½	103½	109½
Pub. Serv. of N. J., 8% pf.	k120	115	122
Pub. Serv. of N. J., com.—no par.	91½	72	93½
Pub. Serv. of No. Ill., 6% pf.	a104	100½	106
Public Serv. of No. Ill., 7% pf.	a113½	112	116½
Pub. Serv. of No. Ill., com.	a134	129½	140
Pub. Serv. of Okla., 7% pf.	95	92	97
Pub. Serv. Elec. & Gas, 6% pf.	k102½	97	104
Public Service Elec. Pwr., pf.	k111½	106	114
Puget Sound Pwr. & Lt., 7% pf.	102	....	....
Puget Sound Pwr. & Lt., 6% pf.	83	....	....
Puget Sound Pwr., & Lt., com.	28	28	66½
RADIO CORP. OF AM., pf.—50	k 48	44½	48½
Radio Corp. of Amer., com.—no par.	43½	32	48½
Republic Ry. & Lt., pf.	106	....	....
Republic Ry. & Lt., com.	80	....	....
Rochester Gas & Elec., 5% pf.	95	80	98
Rochester Gas & Elec., 6% pf.	102	....	....
Rochester Gas & Elec., 7% pf.	104	105	107
SAN JOAQUIN LT. & PWR., 7% pf.	97	97½	98½
Safety Cable, com.	k 52½	42½	54½
St. Joseph Ry., Lt., Ht. & Pwr., pf.	67	60	70
Servel Corp.	21½	21½	22½
Sierra Pacific Elec., com.	27	....	....
Sioux City Gas & Elec., 7% pf.	98	....	....
S. E. Pwr. & Lt., pf.—$7—no par.	99	....	....
Southeastern Pwr. & Lt., pfc. pf.	65½	....	....
S. E. Pwr. & Lt., com.—no par.	30½	20	46½
So. Calif. Edison, 8% pf.—25	32	32½	33½
So. Calif. Edison, 7% pf.—25	k 27½	27½	28½
So. Calif. Edison, 6% pf.—25	k 24½	24½	25½
So. Calif. Edison, com.	31½	30½	33
Southern Cities Utilities, 7% pf.	85	....	....
Southern Cities Utilities, com.	35	....	....
Southwestern Lt. & Pwr., A	60	....	....
Southwestern Lt. & Pwr., B	60	....	....
Southwestern Lt. & Pwr., $6 pf.	80	....	....
Southwestern Pwr. & Lt., 7% pf.	k104	100	105
Springfield (Mo.) Ry & Lt., 7% pf.	99	95	100
Standard Gas & Elec., 8% pf.	57	53½	57½
Standard Gas & Elec., 7% pf.	103	....	....
Standard Gas & Elec., com.—no par.	55½	51	69
Standard Pwr. & Lt., 7% pf.	k 94	90	97
Staten Island Edison, pf.—$6—no par	95½	....	....
Superheater, com.—no par.	160	....	....
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, com.	330	335	340
TAMPA ELEC., com.	k 50	48	67
Tenn. Elec. Pwr., 6% pf.	88	....	....
Tenn. Elec. Pwr., 7% pf.	101½	....	....
Terre Haute, Ind. & East Trac., pf.	20	20	37
Terre Haute, Ind. & East Trac., com	1	1	7
Tex. Pwr. & Lt., 7% pf.	l105½	102	106½
Tide Water Pwr., 8% pf.	102	....	....
Timken Roller Bearing, com—no par	61½	44½	62½
Toledo Edison, 8% pf.	l113	112	114
Toledo Edison, 7% pf.	102	101	103
Toledo Edison, com.	l102½	101	103
Tri-City Ry. & Lt., 6% pf.	88	87½	89
UNITED GAS & ELEC., 6% pf.	96	....	....
United Gas & Elec., com.—no par.	m 57	56	66
United Gas & Elec. (N.J.), 5% pf.	71	....	....
United Gas Impr.—50	c113½	84½	144½
United Lt. & Pwr., pf.—$4—no par.	50	44	51
United L. & P. pf.—$6.50—no par.	86	81	91
United Lt. & Pwr., com., A—no par	16½	12½	28
United Lt. & Pwr., com., B—no par	a 20	15	31
Utah Pwr. & Lt., 7% pf.	l102	99	103½
Utica Gas & Elec., 7% pf.	04½	....	....
Utica Gas & Elec., com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	92	....	....
Utilities Pwr. & Lt., com. A	k 30½	28½	37
Utilities Pwr. & Lt., com. B—no par.	k 13½	13½	18
VERMONT HYDRO - ELEC., 7% pf.	95	94	96
Virginia Elec. & Pwr., 7% pf.	104	101	105
Virginia Pwr., 7% pf.	108	102	104
Virginian Pwr., com.	70	65	75
WAGNER ELEC., pf.	b 69	61½	85
Wagner Elec., com.—no par.	b 21½	13½	34½
Washington Ry. & Elec., com.	f200	....	....
Washington Ry. & Elec., pf.	f 90½	....	....
Washington Wtr. Pwr., com.	133	130	136
West Mo. Pwr., 7% pf.	92	....	....
West Penn., 7% pf., temp. ctfs.	m100	95½	101
West Penn., com.	m125	118	130
West Penn Elec., pf.	k100	95½	100½
West Penn Elec., Class A.	k 95	88½	97
West Penn Pwr., pf.	k111	108	112
West Va. Lt., Ht. & Pwr., 7% pf.	94½	95	98
West Va. Utilities, 7% pf.—50	45½	43	48
Western Pwr., 7% pf.	94	....	....
Western States Gas & Elec., 7% pf.	92	....	....
Western States Cas & Elec., com.	16	....	....
Westinghouse El. & Mfg., com—50	70½	65	79½
Weston Elec. Instrument, Class A	31½	27½	32½
Weston Elec. Instrument, com.	18½	13½	19½
Wheeling Elec., pf.	94	91	97
Wis. Pwr., Lt. & Ht., 7% pf.	k 90	85	90
Worthington Pump, pf. A	k 66	67½	80
Worthington Pump, pf. B	k 49	53	65
Worthington Pump, com.	28	20½	44½
YADKIN RIVER PWR., 7% pf.	l106	102	107½
Yale & Towne, com.—25	68½	60½	69

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Franacisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Saturday, Aug. 7. *l*Bid, low, high, Wednesday, Aug. 11. *m*Latest quotations available

lien series B bonds totaling $8,804,000 of the corporation, first mortgage 6 per cent bonds of the Nevada-California Power Company totaling $1,289,000 and first mortgage 6 per cent bonds of the Southern Sierras Power Company totaling $1,774,500, to defray the cost of new construction and for general corporate purposes.

The Electric Public Service Company, which serves Findlay, Ohio, and various small communities in that state and Oklahoma with electric light and power, besides controlling an electric railway from Findlay to Toledo and supplying natural gas in Oklahoma, issued fifteen-year 6 per cent secured gold bonds, series B, at 98 and interest to yield over 6.20 per cent, a piece of financing involving a total of $2,000,000. The proceeds from the sale of these bonds will in part provide funds for the acquisition of property and for other corporate purposes.

During the week just past this company also issued three-year 6 per cent gold notes, amounting to $900,000, the price being 99 and interest to yield over 6.35 per cent. The notes were dated Aug. 1, 1926, and they will mature Aug. 1, 1929.

Bonds Called in August.—Among the securities of electric light and power companies called for payment in August in advance of maturity are the following:

Issues	Due	Amount
Southern California Edison, 6s	1944	$33,919,000
West Penn Power, 7s, D	1946	6,000,000
Western United Gas & Elec., 5s	1950	4,649,400
Western United Gas & Elec., 6s	1950	2,104,000
Carolina Power & Light, 5s	1938	3,421,000
Youghiogheny Hydro-Elec. 6s	1949	2,750,000
Clarion River Power, 6½s	1947	2,700,000
North Carolina Pub. Service 6½s	1944	800,000
Western United, 6½s, B	1928	472,000
Western United, 6½s, C	1934	360,000
Wisconsin River Power, 7s	1931	333,900
United Light & Power, 6s	1950	150,000
Maryville Lighting, 6s	1946	117,000
Philadelphia Company, 6s*	1944	269,500
Connecticut Lt. & Pwr., 5½s, B*	1954	56,000

* Not entire issues

Montana Power Sells Stock to Public.—The Montana Power Company has completed the sale to the people of the State of Montana of a large block of its common stock. The campaign, which involved the distribution of 30,000 shares, was conceived with the idea of arousing a wider public interest in the company's affairs. The stock does not represent an additional issue or an increase in the outstanding shares, but was purchased by the company in the open market. It was sold on an installment plan calling for an initial payment of $15 and 40 monthly payments of $1.50 each, making the total purchase price $75 a share. The stock pays 5 per cent dividends.

New Servel Directors Elected.—Richard E. Forrest, director of the United West Indies Corporation and the Chattanooga Estates, and Thomas H. Blodgett, president of the American Chicle Company, and director of the

Remington Typewriter and other corporations, have been added to the board of directors and made members of the executive committee of the Servel Corporation.

Safety Cable Reports Income.—The Safety Cable Company and subsidiaries report for the six months ended June 30 net income of $549,619, after depreciation, taxes, etc., equivalent to $3.37 a share on 163,002 shares of no-par capital stock outstanding. This compares with $566,132, or $4.04 a share, on 140,000 shares outstanding in the similar period of 1925. The consolidated balance sheet as of June 30, 1926, shows current assets of $5,841,144 and current liabilities of $1,052,338, leaving net working capital of $4,788,806.

Montreal Light Shareholders Approve Changes.—Shareholders of the Montreal Light, Heat & Power, Consolidated, approved July 26 changes in the by-laws authorizing a subdivision and conversion of the capital stock of the company. The conversion, as announced in the July 24 issue of the ELECTRICAL WORLD, provides that for each share of the company's old stock the holder will receive one 6 per cent cumulative redeemable preferred share of par value of $50 and three common shares without par value.

Dividends Declared

The quarterly dividends listed below have been announced by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
American Power & Light, com	0.25	Sept. 1
Baton Rouge Electric, com	.62½	Sept. 1
Blackstone Valley Gas & Elec., com.	$1.25	Sept. 1
Central Arkansas Ry. & Lt., pf.	1¾	Sept. 1
Central Gas & Electric, pf.	$1.75	Sept. 1
Cities Service, com.*	½	Sept. 1
Cities Service, com.†	½	Sept. 1
Cities Service, pf and pf. B*	½	Sept. 1
Cities Service, bankers' shares*	½	Sept. 1
Cities Service, bankers' shares‡	½	Sept. 1
Cleveland Elec. Illum., 6% pf.	1½	Sept. 1
Columbus Ry., Pwr. & Lt., 1st pf.	1½	Oct. 1
Columbus Ry., Pwr. & Lt., pf. B	$1.63	Nov. 1
Eastern Shore Gas & Elec., pf	.50	Sept. 11
Fairbanks, Morse & Co., pf.	1¾	Sept. 1
Federal Light & Traction, com.	.20	Oct 1
Federal Light & Traction, com.†	.15	Oct. 1
Federal Light & Traction, pf.	1¾	Sept. 1
Kaministiquia Power, pf.	1¾	Aug. 16
Monongahela West Penn Pub. Serv.	.43¾	Oct. 1
Philadelphia Electric, com.	2	Sept. 15
Philadelphia Electric, com. (extra)	2	Sept. 15
Portland Electric Power, 2nd pf.	1½	Sept. 1
Rockland Light & Power	$1.12	Aug. 2
Southwestern Power & Light, pf.	1¾	Sept. 1
Timken Roller Bearing	$1	Sept 4
Timken Roller Bearing, extra	.25	Sept. 4
Virginia Elec. & Power, Pf.	1¾	Sept. 20

* Monthly.
† Payable in common stock.
‡ Payable in stock.

Public Service Corporation Reports Record Six Months

For the first half of 1926 earnings of the Public Service Corporation of New Jersey and subsidiaries were the largest ever reported by the system for a similar period. Operating revenues of subsidiaries, totaling $52,335,727, increased $6,268,331 over the first six months of 1925. After all deductions, including reserves for depreciation, there remained a balance of $6,888,126 available for dividends on Public Service Corporation stocks, equivalent after preferred dividends to $4.17 a share earned on 1,192,425 shares of common outstanding June 30. This compares with $4,091,774, or $2.84 on 924,080 shares outstanding June 30, 1925. While gross earnings of subsidiaries increased more than $6,000,000 in the first six months, their operating expenses, maintenance and taxes were only about $2,500,000 greater than in the corresponding period of 1925. Nearly one-half of the gain in gross, therefore, was saved for net. For the twelve months ended June 30 net income available for Public Service common was $9,125,137, equivalent to $7.65 a share, as compared with $5,261,251, or $5.69 a share, for the preceding twelve months.

West Penn Power to Redeem Old Bonds

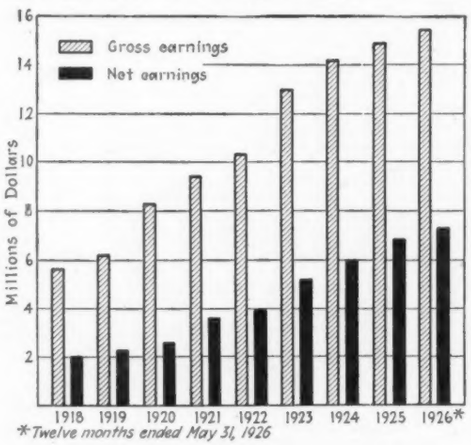
New Issue of 5's Totaling $18,500,000 Will Be Used in Part to Recall Outstanding 7's—Annual Gross Now Equals $15,400,000

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

GREATER ease in the money market and improvement in its own earnings have enabled the West Penn Power Company to provide for the retirement of a bond bearing a 7 per cent coupon by substitution of one that will bear a 5 per cent rate. In floating an issue of $18,500,000 of first mortgage 5 per cent bonds of 1956 the management expects to obtain funds that will enable it to redeem the $6,000,000 of first mortgage 7's among other things.

As the best known operating subsidiary of the American Water Works & Electric Company, the West Penn Power Company operates an extensive system of electric power and light properties in 437 communities in the great industrial area adjacent to Pittsburgh in southwestern Pennsylvania. By steady yearly gains the company's gross revenues have risen from $5,670,767 in 1918 to $15,430,463 for the twelve months ended May 31, 1926. That represents remarkable growth for an eight-year period. Net earnings in the same period have had an even more rapid growth relatively than gross, having improved by yearly steps from $2,004,637 in 1918 to $7,263,443 for the year ended May 31.

These figures reveal how the company's gross business has improved since 1918 and how that improvement has been reflected in the net earnings available for interest charges. But it is necessary to go one step further to understand in full the improvement, for the good gains in net earnings have been accompanied by only moderate increases in the first mortgage interest charges, so that the yearly balance shown after such charges has risen from $1,534,736 in 1918 to $5,380,943 in the twelve months ended May 31, 1926. In kilowatt-hours the improvement for the period represented is reflected in a gain for annual sales from 307,323,721 to 876,355,463.



EARNINGS OF WEST PENN POWER COMPANY SINCE 1918

Of the company's transmission system and its possibility for increasing future earnings, A. M. Lynn, president of the West Penn Power Company, has the following to say:

"The company owns 179 high-tension substations, having a transformer capacity of 253,266 kw., exclusive of consumer-owned substations with a capacity of 76,123 kw. connected with the company's transmission system, and 914 pole miles of high-tension transmission lines (exclusive of low-tension distribution lines), including 147.7 miles of steel-tower lines of 132,000-volt construction. The number of light, heat and power consumers as of Dec. 31, 1925, was 99,134 and the total connected load 374,000 kw. The rapid growth of the properties owned by West Penn Power Company in the three years ended Dec. 31, 1925, is evidenced by an increase in the number of consumers of 61 per cent, in the total connected load of 29 per cent and in the annual kilowatt-hour output of more than 49 per cent. Contracts for service where connections have not as yet been made will yield additional revenue estimated in excess of $900,000 per year."

Company Reports

The following statements of earnings have been issued by electric light and power companies for the month of June:

Name of Company	Gross Earnings for June 1926	1925
American Water Wks. & El.	$3,576,448	$3,268,978
Barcelona Trac., Lt. & Pwr.	6,827,982	6,633,114
Community Power & Light	361,407	329,530
Federal Light & Traction	498,859	441,949
Jamaica Public Service*	53,514	49,531
Los Angeles Gas & Electric	497,527	484,716
Nevada-California Electric	643,219	705,080
Washington Ry. & Electric	414,338	399,664
West Penn Electric	2,650,923	2,015,789
York Utilities	14,568	13,782

* May

Manufacturing and Markets

July Construction Heaviest for That Month

ENGINEERING construction contracts awarded in the entire United States for the month of July were $299,099,000, as against $212,509,000 for the same month last year. The July volume of contracts are the heaviest on record for that month, according to the *Engineering News-Record* statistics. Buildings and construction other than buildings both gained 41 per cent in total contracts, comparing July this year with last.

The construction volume index number for July was 248, against 201 for the whole of 1925 and 100 for 1913. This index number covers the actual volume of construction and not the mere money value of contracts let. The actual volume of July contract letting is thus seen to be greater than that for any month this year except May and is the heaviest July on record.

The accompanying table shows the value of contracts let in the United States and Canada during July and includes all waterworks and excavating jobs valued at $15,000 and over; other public works, $25,000 and up; industrial buildings at a minimum of $40,000, and commercial, public and other buildings of $150,000 value or more. Contracts awarded for the entire United States, Jan. 1 to Aug. 1. 1926, were 23 per cent ahead of the same period last year. The totals were $1,659,106,000 and $1,350,868,000 respectively. At the same time proposed work amounted to $3,363,759,000, as against $2,856,487,000 for the first seven months of 1925, a gain of 17 per cent in buildings and 19 per cent in construction other than buildings. All states showed gains in contract letting, comparing July with the same month last year, except the following thirteen: New York, New Jersey, Pennsylvania, South Carolina, Minnesota, Oklahoma, Wyoming, Utah, New Mexico, Arizona, Washington, Oregon and California.

The gain in building projects is significant in that many of the principal cities report a steady decrease since 1924 in shortage of business buildings, apartments and single family dwellings. Absence of actual shortage does not necessarily inhibit building operations, since present demand for new and better accommodations and full ability on the part of the public to pay for them, plus steady growth in population, serve to insure a large volume of future construction. This ability to pay for construction is based on prevailing high wages, full employment of labor, easy money rates and absence of further inflation in materials prices.

Value of Contracts Let in the United States and Canada, July, 1926

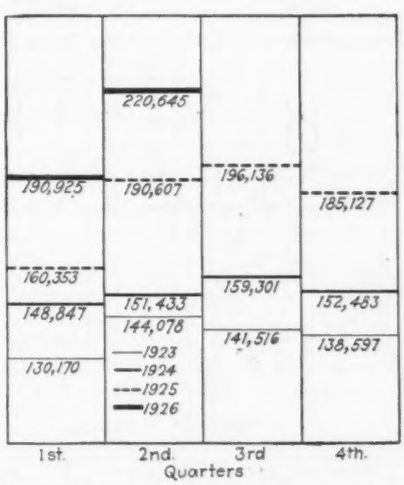
	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to Date U. S.	Canada
Waterworks	$796,000	$874,000	$406,000	$1,416,000	$1,763,000	$37,000	$5,292,000	$34,626,000	$25,000
Sewers	204,000	1,000,000	296,000	6,133,000	1,695,000	680,000	10,008,000	57,993,000	27,000
Bridges	362,000	2,046,000	2,229,000	1,709,000	1,127,000	406,000	7,879,000	42,562,000	108,000
Excavation, drainage, irrigation	129,000	170,000	486,000	33,000	896,000	173,000	1,887,000	14,254,000	.....
Streets and roads	3,143,000	14,075,000	12,183,000	17,241,000	11,801,000	4,882,000	63,325,000	285,798,000	2,727,000
Industrial buildings	1,979,000	3,004,000	2,065,000	11,829,000	1,495,000	1,261,000	21,633,000	196,254,000	2,800,000
Commercial buildings	26,937,000	35,198,000	5,115,000	50,667,000	14,814,000	12,038,000	144,769,000	847,074,000	5,983,000
Federal government	132,000	948,000	2,654,000	1,274,000	1,314,000	1,190,000	7,512,000	29,930,000	.....
Unclassified	312,000	6,163,000	530,000	3,983,000	24,708,000	1,093,000	36,794,000	150,615,000	4,807,000
July, 1926	$33,994,000	$63,483,000	$25,964,000	$94,285,000	$59,613,000	$21,760,000	$299,099,000	$1,659,106,000	$16,477,000
June, 1926	24,260,000	77,073,000	14,402,000	66,626,000	32,078,000	23,186,000	237,625,000	.....	10,434,000
July, 1925	14,486,000	78,340,000	12,389,000	39,424,000	35,506,000	32,404,000	212,509,000	.....	7,570,000
Jan. 1 to date, 1926	137,193,000	516,319,000	182,504,000	404,762,000	250,709,000	167,619,000	1,659,106,000	.....	79,398,000
Jan. 1 to date, 1925	114,602,000	466,035,000	109,347,000	240,091,000	241,321,000	179,472,000	1,350,868,000	.....	48,101,000

Washing-Machine Sales Show Surprising Strength

Sales of washing machines showed a surprising strength during June. There was a gain in all types of machines with the single exception of water-power. With practically no exceptions in the history of the industry, June has always shown a seasonal decline prior to this year. Sales in June, 1926, have more than held up, and this despite the fact that for the three months preceding June there was the largest movement of electric machines for any ninety-day period in the history of the industry. The accompanying table and cut compare the various sales figures from 1923 to the present time.

For the half year ended June 30 there has been a gain over the first half of 1925 of 882 hand-power machines, 4,135 water-power machines, 17,049 gas and engine-power machines and 60,610 electric machines, making a gain of 82,676 in all types. The total number of machines sold in the first half of 1926 is 511,239, of which number 411,570 were electric machines.

It is interesting to note that the sale of the higher priced machine—that is, the gas and engine power—which moves largely to the agricultural trade, has shown over 100 per cent increase in the half year just ended.



SALES OF ELECTRIC WASHING MACHINES BY QUARTERS, 1923-1926

Sales of Washing Machines by Quarters 1923-1926 (Except Electrics)

Electric Washing Machine Sales Shown Separately

(Data Supplied by American Washing Machine Manufacturers' Association)

Quarter	Hand-Power Machines				Gas and Power Machines				Water-Power Machines				Total Including Electric Machines			
	1923	1924	1925	1926	1923	1924	1925	1926	1923	1924	1925	1926	1923	1924	1925	1926
First	35,317	22,079	25,174	26,854	5,934	3,803	6,762	13,742	7,352	4,732	5,475	7,228	179,058	179,461	197,764	238,749
Second	30,811	20,470	25,314	24,516	6,319	4,310	9,034	19,103	7,758	4,023	5,844	8 226	188,176	180,227	230,799	272,490
Third	30,212	19,036	22,348	.....	4,289	3,987	10,431	.....	6,947	5,078	5,665	.....	172,964	187,402	234,580	.....
Fourth	19,063	20,748	20,922	.....	3,568	4,842	9,518	.....	6,498	3,729	3,789	.....	167,726	181,802	219,356	.....
Total	105,403	82,333	93,758	.....	20,110	16,933	35,745	.....	28,555	17,562	20,773	.....	707,924	728,892	882,499	.....

July Activity High

Manufacturing Below June, but Slightly Above May and Well Above July of Last Year

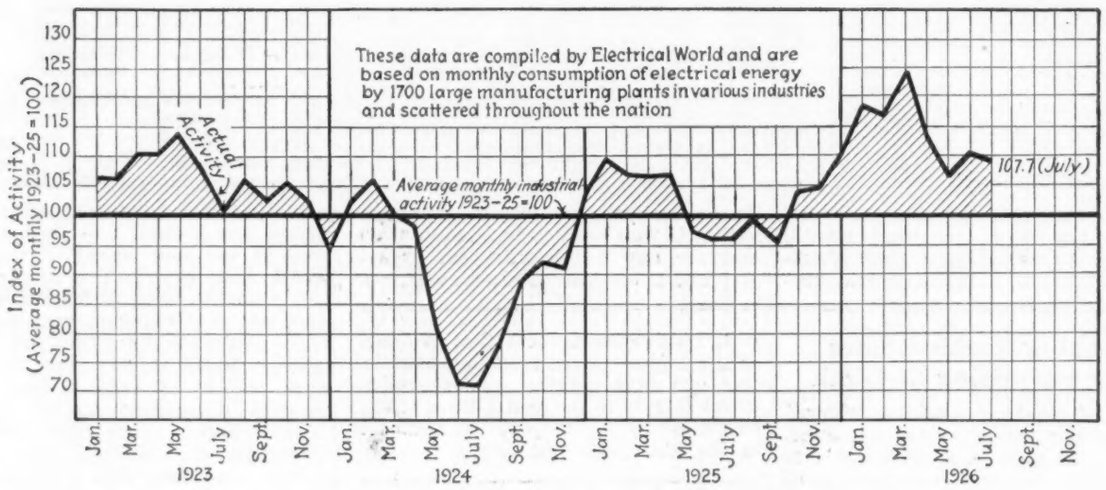
ACTIVITY in the manufacturing plants of the nation during July was under that reported for June, but slightly above that during May and materially above that of July last year. All of the six leading manufacturing industries of the country—metals, textiles, stone, clay and glass, automotive, lumber and leather—reported July activities below those of June, with the single exception of the leather industry, which appears to have experienced an upward trend during the month. July manufacturing activity, however, was still of a high order, being about 12 per cent over that reported for July of last year and 7.7 per cent above the average monthly activity for the past three years. Such is the picture of industrial operations painted by the national data received by the ELECTRICAL WORLD and based upon the monthly electrical energy consumption of about 1,800 manufacturing plants in various industries and scattered throughout the nation—plants consuming about 8,000,000,000 kw.-hr. per annum.

The returns received by the ELECTRICAL WORLD indicate that July general industrial activity in the nation as a whole was 7.7 per cent above the average monthly activity for the past three years, this figure being unadjusted for seasonal variation, but weighted in accordance with the importance of the various industries. The prosperous condition of American industry today is even more clearly indicated when the fact is included that in July of last year general industry in the nation as a whole was operating at 3.5 per cent below the average monthly. When it is remembered that July is normally the lowest month in industrial activity, these high operating figures are even more significant.

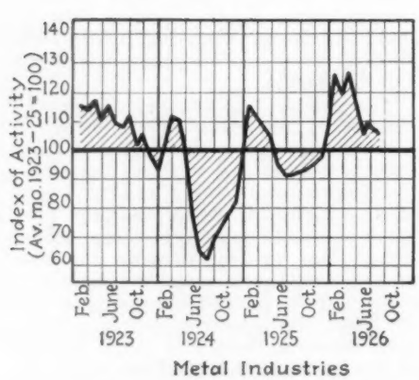
The metal industries taken as a group and for the nation as a whole reported activity during July as 3.2 per cent under that of June but 17.5 per cent over that of July last year. Activity in the rolling mills and iron and steel plants was 2.8 per cent under June. The fabrication plants of the industry, both ferrous and non-ferrous, were 4.7 per cent under June. A decided but more or less seasonal drop was witnessed in the textile industry.

"Electrical World" Barometer of Industrial Activity in the United States as a Whole

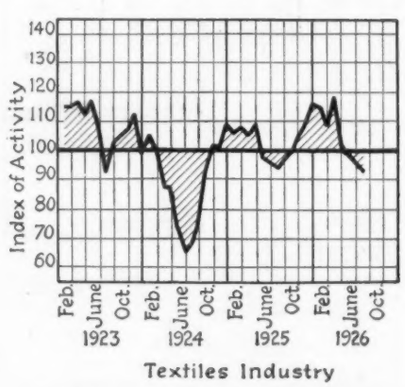
(Data Unadjusted for Seasonal Variation)


These data are compiled by Electrical World and are based on monthly consumption of electrical energy by 1700 large manufacturing plants in various industries and scattered throughout the nation
Index of Activity (Average monthly 1923-25=100)
Actual Activity
Average monthly industrial activity 1923-25=100
107.7 (July)
Jan. Mar. May July Sept. Nov.
1923 1924 1925 1926

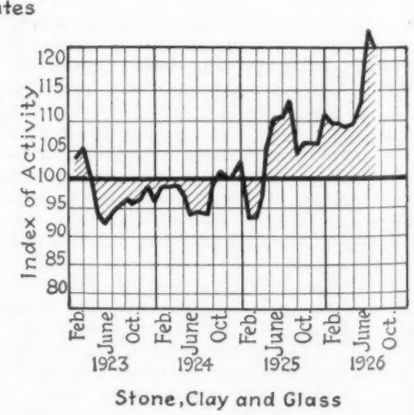
General Industrial Activity in the United States



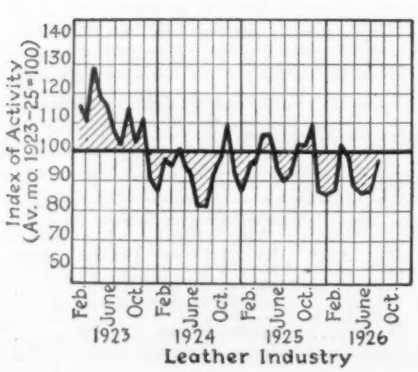
Metal Industries



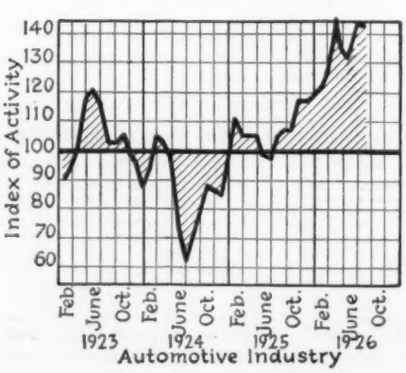
Textiles Industry



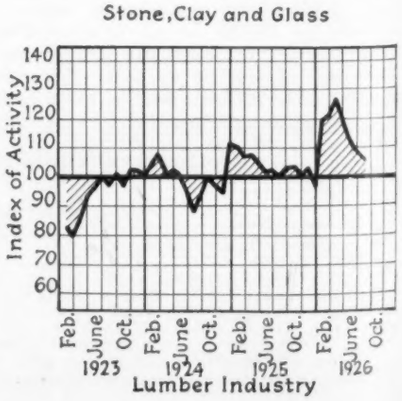
Stone, Clay and Glass



Leather Industry



Automotive Industry



Lumber Industry

Value of Electrical Exports for June, 1926, Compared with Corresponding Month in 1925

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	June 1925	June 1926
Generators:		
Direct-current:		
Under 500 kw.	$41,590	$84,962
500 kw. and over	5,062	17,386
Alternating-current:		
Under 2,000 kva.	31,632	17,618
2,000 kva. and over	49,900	157,110
Steam-turbine generator sets	29,470	55,549
Accessories and parts for generators	52,012	102,432
Self-contained lighting outfits	58,199	62,832
Batteries:		
Flashlight batteries	86,902	96,176
Other primary batteries	88,315	195,664
Storage batteries	198,921	278,535
Transforming or converting apparatus:		
Power transformers	110,202	96,324
Other transformers	112,663	91,565
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	87,953	102,677
Transmission and distribution apparatus:		
Switchboard panels, except telephone	79,502	109,938
Switches and circuit breakers over 10 amp.	90,826	150,845
Fuses and fuse blocks	22,506	23,904
Watt-hour and other measuring meters	31,231	23,755
Volt, watt and ampere meters and other recording, indicating and testing apparatus	144,346	195,357
Lightning arresters, choke coils, reactors and other protective devices	45,770	55,466
Motors, starters and controllers:		
Motors under 1 hp.	147,172	186,322
Stationary motors:		
1 to 200 hp.	152,447	248,527
Over 200 hp.	33,360	70,297
Railway motors	21,619	86,139
Electric locomotives:		
Railway	.....	.....
Mining and industrial	22,497	72,227
Starting and controlling equipment:		
For industrial motors	76,559	102,693
For electric railway and vehicle motors	10,069	16,127
Portable electric tools	*	46,935
Accessories and parts for motors	117,384	150,738
Electric appliances:		
Electric fans	07,154	66,226
Electric lamps:		
Metal filament	87,972	122,726
Other electric lamps	33,952	18,065
Flashlights	115,121	165,399
Searchlights and projectors	40,457	31,626
Motor-driven household devices	$23,421	$101,001
Domestic heating and cooking devices	110,875	118,743
Industrial electric furnaces and ovens	34,015	15,592
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	139,403	145,497
Signal and communication devices:		
Radio apparatus	670,605	444,396
Transmitting sets and parts	*	4,849
Receiving sets	*	157,790
Tubes	*	58,851
Receiving-set components	*	104,478
Receiving-set accessories	*	118,428
Telegraph apparatus	32,581	69,047
Telephone apparatus:		
Magneto telephones	5,672	9,468
Other telephones	38,214	28,421
Telephone switchboards	31,444	1,427,660
Other telephone equipment	141,560	264,428
Railway signals, switches and attachments	77,094	32,485
Bells, buzzers, annunciators and alarms	16,859	35,500
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	394,899	139,731
Insulating material	130,013	121,141
Metal conduit, outlet and switch boxes	55,404	116,739
Sockets, receptacles and lighting switches	120,900	128,809
Electric lighting fixtures, interior and street	85,021	120,625
Other wiring supplies and line material	67,727	117,894
Other electrical apparatus not elsewhere stated	440,562	635,669
Rubber and friction tape	*	33,446
Globes and shades for lighting fixtures	39,199	48,413
Electrical glassware except for lighting	15,187	60,063
Electrical porcelain:		
For less than 6,600 volts	44,699	76,944
For 6,600 volts and over	50,210	61,971
Carbons, carbon brushes and electrodes:		
Electrodes for electric furnaces	91,551	151,253
Other carbon products	227,454	78,735
Insulated wire and cable (iron and steel)	18,988	10,279
Copper, bare wire	114,952	294,037
Copper, insulated wire and cable	318,856	401,096
Total electrical machinery and apparatus and supplies	$5,940,813	$8,591,574

* Not separately stated prior to Jan. 1, 1926

Business Conditions

STEADY buying of electrical equipment and supplies is noted virtually throughout the country. Some inactivity is reported from certain sections, but the outlook in such cases is also referred to as encouraging. Sales of motors are in large volume for this period, and line-construction materials continue in strong demand, particularly from the Middle West, South and Southeast. Orders for generating equipment amounting to well over $1,000,000 have also been reported. Unfilled orders of the United States Steel Corporation were reported as showing an increase of 123,880 tons on Aug. 1—the first increase since last December. Recent developments in that field indicate a return by some consumers to the old practice of placing orders ahead.

In New England sales are increasing in volume, and motor business is particularly encouraging. An order was placed by a steel corporation for a 2,500-hp. motor, and a number of orders were placed for small motors, outstanding among which was one for 5,000 units. Much activity is recorded by manufacturers of switch and control equipment, and orders for wire and line hardware have gained in volume. Buying is inactive in the New York district, but the outlook is good as several construction and expansion projects are under discussion for immediate development. In the Southeast diversified sales are reported in good volume, with a steady demand from south Georgia for line construction materials and transformer substation equipment. Mining companies are active in the St. Louis district and sales of merchandise lines are holding up splendidly, but orders for some lines of equipment are below normal. Business continues at a good rate in the Middle West, and encouraging reports are received from the agricultural districts as well as the manufacturing centers. On the Pacific Coast July sales are reported as distinctly better than those of June, and business in August is continuing the upward trend. Proposed activities of power companies, particularly in Seattle and western Washington, presage heavy sales of generating, substation and line-construction equipment.

Metal Market Quieter but Prices Firm—Tin at New High

The volume of copper sales has taken a marked drop, and there was also less inquiry for lead. Prices were well maintained for both of these metals by most sellers, however. Zinc was somewhat more active, though at a little lower prices. Tin touched the highest price in seven years, with the demand somewhat exceeding production and short supplies. The large copper producers have been almost uniformly at the 14½-cent level for Eastern deliveries all week and at 14⅝ cents in the Middle West, but have sold practically nothing except to regular customers who are not inclined to haggle about prices. The market has been so quiet that several sellers, mainly the smaller ones, have had to shade those prices, and even then the total tonnage sold was less than half of the previous week. Some consumers near the refineries have been able to obtain copper for as low as 14.35 cents, delivered, whereas several sales at Connecticut points have been made between 14.375 cents and 14.45 cents. Most of the copper sold has been for September or October delivery, though an occasional demand for August appears. Sellers make no distinction in price. Inasmuch as the volume of sales in July was the greatest in at least a year, no great concern is felt at the present quiet market.

The contract price of lead set by the American Smelting & Refining Company remains at 8.90 cents, New York, and the principal sellers in the Middle West have also been quoting substantially unchanged prices. Some lead has been sold in the East at slight premiums. Both the volume of inquiries and the number of sales have been less than last week, though the situation continues firm and no important change in price seems in prospect. Zinc has been somewhat weaker, one sale having been reported as low as 7.275 cents, St. Louis, last week Friday, though on the same day a carload of October metal was sold at 7.45 cents. Since the statistics were issued prices have firmed up slightly, the stocks having undergone another substantial decline. Spot, Straits tin, sold as high as 66¼ cents on Monday of this week, when business was active, but has since reacted so that prompt deliveries could be obtained on Wednesday at but little above 65 cents. The high price established a peak for the post-war market.

NEW YORK METAL MARKET PRICES

	Aug. 4, 1926 Cents per Pound	Aug. 11, 1926 Cents per Pound
Copper, electrolytic	14.525	14.425
Lead, Am. S. & R. price	8.90	8.90
Antimony	15⅛	16⅛
Nickel, ingot	35	35
Zinc spots	7⅛	7.70
Tin, Straits	65⅛	65.375
Aluminum, 99 per cent.	27⅛	27⅛

Base copper price Aug. 11, 1926, 16½ cents.

Sales in the New England District Increasing in Volume

As compared with July, the present month to date shows increased activity in the sale of electrical supplies and equipment throughout the New England district. Motor business is particularly encouraging. An order was placed by a prominent steel corporation for a 2,500-hp. motor, and, in addition, a number of orders for small motors are reported by manufacturers, of which one for a group of 5,000 is outstanding. Orders have also been placed by manufacturers of oil-burning and machine-tool equipment. Central-station supplies are moving better than last month and manufacturers of switch and control equipment record much activity in that line. Orders for wire and line hardware have gained in volume over those received during the first week of last month.

Industrial electric heating negotiations are progressing favorably. Three interesting projects are reported by one manufacturer as under consideration, and greater activity is forecast among the machine-tool industries during the coming fall. Electric vehicle sales are gaining, and three delivery-type trucks were recently added to a large fleet. The demand for electric refrigerators, as reported by a public utility company in southern New England, is far in excess of that last summer. Electric range sales are active and many deliveries of this equipment were reported recently. Household appliance sales are spotty, but the demand for cleaners, cookers and washers is quite active. New construction is surprisingly strong and the purchase of wiring supplies is brisk. Proposals for line equipment consisting of wire, conduit and cable are being submitted for extension of third-rail service of the Dorchester Rapid Transit system.

Diversified Sales in Good Volume in Southeast

Generally good sales in all lines of electrical goods is the report for the Southeast. The volume of line-construction material orders continues most satisfactory, though there are few large single orders to be noted, and there is a considerable number of orders for this material which are pending and should materialize in the near future. Purchases of electrical construction materials by large contractors are reported good, and orders for wiring supplies going into commercial buildings are also coming through in good volume. Conduit sales are very satisfactory and include an order for $4,000 worth of rigid iron conduit placed by a large power company. Central-station purchases of substation eqipment continue very active and some excellent orders were received by manufacturers. South Georgia is in for a period of intensive development and a large volume of line-construction materials and transformer substation equipment is going into this territory. Electric signs are more active than for some time, and bids have been asked on one installation of two signs, each 150 ft. long, with the lettering 8 ft. in height. Contract is to be let this week for a considerable amount of electric motor equipment for a water pumping and filtration plant in Florida. An order was recently placed for two industrial storage-battery locomotives for Birmingham delivery, and batteries for remote-control equipment are in satisfactory demand.

Business Continues at Good Rate in Middle West

Conditions of all points of the Middle West indicate that business is continuing its present rate. Encouraging reports from agricultural districts coupled with good statements from manufacturing centers lend a decidedly optimistic view to the outlook. There is no recession seen in building activity and apparently August will be another good month in business. The various utility companies are busy extending their lines of operation, and while no notably large orders for apparatus are being placed, maintenance purchases are quite large with the general volume of utility business assuming sizable proportions. Among the interesting orders placed were one for a set of station-type storage batteries valued at over $200,000, three hundred 75-kv. single-conductor cable joints, and a sizable order for spare turbine parts. There has been a good demand for cable, weatherproof wire, pole-line hardware and other line construction material. Jobbers report good business. The consensus of opinion is that appliance sales are 25 per cent to 30 per cent ahead of last year, with better business in view. A considerable amount of business is being obtained in the electric dishwasher field, while the sales of electric refrigeration machines are increasing steadily.

Buying Inactive in New York District but Outlook Good

Sales to central-station companies in the New York district have shown a material decrease in practically all lines during the past ten days. This condition is generally believed to be only temporary, and it is anticipated that normal buying will be resumed at an early date. Transformer sales are particularly small, although several construction and expansion projects are under discussion which will create a demand for this material in the near future. The demand for switching equipment, pole-line hardware, etc., is fair, although this, too, is considerably less than last month. In the industrial field there is a noticeable decrease in activity. Paper mills and machine-tool manufacturers are buying in fair volume, and it is expected that orders for several motors up to 300 hp. for refrigerating plants will be placed within ten days.

Upward Trend in Sales Continues on the Pacific Coast

July business on the Pacific Coast is reported as having been distinctly better than that of June, and sales in August are continuing the upward trend. Orders are distinctly larger than the average for several months past. This is especially true of interior and Coast Valley districts, whose harvesting and canning may set a new record. Deciduous-fruit carload shipments, for instance, are 10,108 to date, as compared with 5,768 for the same period last year. Power-company purchases include much pole-line hardware, 30,000 fuse plugs, one carload 7-in., 35-ft. poles and several construction tools. Railroad buying is comparatively quiet. Contractors' inquiries in the San Francisco Bay region have included 7,000 fancy toggle plates to match various woodwork finishes, $5,000 worth of floodlighting equipment and 1,000 lighting units for the Stockton Medico-Dental Building. An inquiry for 9,000 each of crowfoot zincs, pencil zincs and battery coppers is reported from a Manila railway. Machinery and special industrial orders include $4,000 worth of industrial heating material, $60,000 worth of feeder regulators for three substations in the vicinity of San Francisco, a high-speed traction elevator equipment for Oakland worth $10,000, one carload of 100,000-volt suspension insulators for regular replacement and an order from San Francisco for $4,000 worth of miscellaneous catenary railway material.

Proposed activities of power companies in Seattle and western Washington looking toward immediate developments will mean heavy sales of generating, substation and line construction equipment, and the city of Seattle will issue specifications for $250,000 worth of equipment for its Spring Street substation. Construction will start at a very early date on the 1,200-ft. dam at Diablo Canyon, the site having been selected. This is the second unit in the Skagit River hydro-electric project. Motor awards include equipment for a sixty-thousand-dollar lumber mill in Seattle, an addition to a plant at Kelso involving 250 hp. in motors, an addition to a mill at Longview and apparatus for a fifty-thousand-dollar mill and a fertilizer plant at Sedro Woolley.

Mining Companies Active in St. Louis District

Business during August has fallen below normal in some lines, but jobbers and manufacturers agree that sales of all merchandise lines are holding up splendidly. One of the large Diesel engine builders has just placed an order for a 500-kw. motor-generator set and three transformers. Another order, totaling about $100,000, has been placed for turbines, generators, motors and switching equipment to be installed in a large oil refinery at Robinson, Ill. The increase in the price of lead and zinc ores has caused still more activity in the mining district to the southwest of St. Louis. One of the largest mine companies in the Miami (Okla.) district bought generators, motors and line material amounting to about $100,000. Other mining companies in southwest Missouri are drilling to prove up their ore deposits and getting prices on electric equipment for their mills, hoists and underground lighting and haulage. If the present price of ore holds up, there promises to be unusual activity throughout the entire lead and zinc districts contiguous to St. Louis.

Activities of the Trade

Delco-Light Company Announces Reduced Prices on "Frigidaire"

Price reductions, ranging from $20 to $90, have been made on all lines of "Frigidaire" metal cabinet models, residential and commercial installations and also cooling units designed for use in the standard makes of iceboxes, according to an announcement by the Delco-Light Company, Dayton, Ohio. The company states that its sales so far this year amount to more than 200,000 electric refrigerator units, and the price reduction was made possible through quantity production and increases in output planned for 1927. Business for the first seven months of 1926 indicates that sales will pass far beyond the eighty-million-dollar mark set as the goal for the year. The factory schedule calls for an output of 600,000 refrigeration units next year. The company has already let contracts for its new factory buildings and expects that they will be completed early in October, when machinery installation will proceed.

Westinghouse Receives Large Turbo-Generator Contracts

Large turbo-generator contracts recently received by the Westinghouse Electric & Manufacturing Company include one from the Duquesne Light Company of Pittsburgh for a 60,000-hp. turbo-generator unit, one 62,500-sq.ft. steam condenser with auxiliaries, and three transformers, each rated at 31,400 kva. Another contract has been made with the Binghamton Light, Heat & Power Company, Binghamton, N. Y., and calls for one 45,000-hp. turbo-generator unit as well as three transformers rated at 11,765 kva. each.

Trumbull-Vanderpoel Company Announces Reorganization

At a recent meeting of the Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., manufacturer of safety switches, knife switches, etc., Harmon J. Cook of Torrington, Conn., was elected president to succeed Ralph K. Mason, who resigned and has also sold his interests in the company. The new officers are Harmon J. Cook, president; John H. Lancaster of Litchfield, Conn., vice-president and general counsel, and James N. Miller of Torrington, Conn., secretary and treasurer. The board of directors, which consists of men prominent in the industrial and banking affairs of Litchfield County, include Howard J. Castle, Torrington, Conn., treasurer of Hotchkiss Brothers Company; Frank J. Damon, Torrington, Conn., vice-president of the Union Hardware Company; Frederick P. Weston, Litchfield, retired, formerly president of the Torrington Company; V. Russell Leavitt, Hartford manager of Paine, Webber & Company; Harmon J. Cook and John H. Lancaster. It is said that the company plans considerable expansion in the near future.

The Leonard Refrigerator Company, Grand Rapids, Mich., announces a simplification in its line of refrigerators. Fewer models will be made, the company having announced its purpose to concentrate production on styles and sizes which have proved themselves best sellers in the market.

Walker Brothers, 620 South Delaware Avenue, Philadelphia, manufacturers of underfloor steel duct systems and fittings, are having plans prepared for extensions and improvements in their new plant at Spring Mill, near Conshohocken, Pa., where property recently was acquired from the Philadelphia Terra Cotta Company. A one and two-story extension will be erected, 50 ft. x115 ft.

The Graybar Electric Company announces the opening of a new sales and warehouse branch at Hartford, Conn. The new branch will be located at 51 Chapel Street and will have a total floor area of 3,500 sq.ft. It is expected to be in operation by Aug. 15. With the opening of the Hartford branch, the Graybar company will have 59 distributing houses located in as many different cities stretching from coast to coast. J. W. Saliadine, at present in charge of Hartford sales for the company, will be sales manager of the new branch and warehouse.

The National Carbon Company, Inc., 30 East Forty-second Street, New York, announces the appointment of Harry S. Schott as general sales manager. For the past two years Mr. Schott has been assistant general sales manager for the company.

The General Electric Company announces that it plans late this fall to start supplying type AO and type DO ammeters and voltmeters with certain classes of automatic switching equipments to meet the growing demand for such instruments. The company states that instruments supplied with certain classes of automatic stations are used principally for obtaining periodic indications of voltage and current conditions in these stations, and as they are not generally used for the regulation of circuits extreme accuracy is not essential.

The Pittsburgh Reflector Company, Bowman Building, Third Avenue and Ross Street, Pittsburgh, announces a new "Windo-Spot" No. 500 for show window lighting and for other uses where an intense beam is desired. The unit uses a 300-watt or 500-watt lamp.

New Equipment Available

Motor-Operated Mechanism for Closing Oil Circuit Breakers

An addition to the Westinghouse Electric & Manufacturing Company's line of oil-circuit-breaker-operating mechanisms is the type CF-2 motor-operated unit which is designed for closing oil circuit breakers rated at 110 kv. and up. This mechanism is equipped with a universal wound motor for use on direct current at 250 volts or 60-cycle alternating current at 110 volts. Similar motors for operation on alternating-current circuits at 220 volts can also be supplied. The mechanism utilizes the centrifugal principle whereby the outward movement of a pair of weights rotating at high speed forces the breaker to the closed position. This unit has been developed especially for use at isolated locations where no battery is available.

Magnetic Brakes

New magnetic brakes, types DI and AI, being manufactured by the Westinghouse Electric & Manufacturing Company for both direct-current and alternating-current service, in addition to being spring-set and easily adjustable, are said to have unusually small dimensions. The small diameter of the brake wheel requires less power to operate and less time for starting and stopping. A weatherproof cast steel housing is provided for the magnet, and the magnets of the two types of brakes are interchangeable. With this design the same equipment may be used for both alternating-current and direct-current work by merely changing the magnet. A manual release enables the motor to be operated without the brake during inspection or test.

High-Temperature Cement

A high-temperature cement composed of a chrome-ore base, free from sodium silicate and other low-fusing binders, has been placed on the market by the General Refractories Company, 117 South Sixteenth Street, Philadelphia. This cement, known as "Grefco," is of a neutral character, and it offers resistance to acid as well as basic slags. It is said to be especially desirable as a mortar and protective coat for boiler setting and similar furnaces where coal and ash slags are formed. It is also said to set hard and uniformly and to maintain a constant bond through all temperatures. Its fusion temperature is over 3,500 deg. F.

Contactors.—Three new low-voltage shunt contactors are now placed on the market by the General Electric Company. These contactors, bearing the designations CR-2810-1314, CR-2810-1315 and CR-2810-1316, are of the 600-amp. type and supersede three 500-amp. contactors. The new contactors have one large contact tip per pole; the arc chute is larger and more effective for interrupting large currents, and the number of turns on the operating magnet coil has been changed to increase the power of the magnet. The maximum interrupting ability is approximately 10,000 amp. at 600 volts or less.

New Trade Literature

SHOW-WINDOW REFLECTOR.—A Bulletin describing the Pittsburgh "Window-Spot" No. 500, for show-window lighting and for other uses where an intense beam is desired, has been published by the Pittsburgh Reflector Company, Bowman Building, Third Avenue and Ross Street, Pittsburgh.

CARBON PRODUCTS. — Catalog B-4 issued by the United States Graphite Company, Saginaw, Mich., describes its carbon products. The catalog contains the standards for carbon brushes and shunts in accordance with the recommendations of the Division of Simplified Practice, Department of Commerce, and a chapter is devoted to the characteristics of "USG" motor and generator brushes. Illustrations of the various types of shunts are included as well as complete dimensions. Attention is also called to the "USG" carbon packing rings for use on steam turbines, and other carbon specialties.

LABORATORY EQUIPMENT.—"Electrical Laboratory Apparatus and Educational Service" is the title of bulletin GEA-450, issued by the General Electric Company. The bulletin is well illustrated and covers alternating current generators, sine wave testing sets, capacitors, transformers, meters, etc., built especially for laboratory use.

TRANSFORMER SUBSTATION. — The Pittsburgh Transformer Company, Pittsburgh, has issued bulletin No. 2056, containing information concerning the installation of a new substation at the Manchester plant of the company. Photographs and drawings of the layout are included.

CRANES. — The Whiting Corporation, Harvey, Ill., has issued Bulletin No. 176 giving the standard building clearances for its overhead electric traveling cranes.

STEAM PURIFIER. — The Andrews-Bradshaw Company, 530 Fourth Avenue, Pittsburgh, has published a bulletin describing its "Tracyfier." The bulletin outlines the reason for the development of the "Tracyfier," and contains a number of illustrations of central-station plants where the "Tracyfier" is installed. A diagram shows a typical installation, and a chapter, illustrated with graphs, tells what the "Tracyfier" will do.

RESIDENCE PANELS.—A circular describing a new four-circuit residence panel on a porcelain base has been issued by the Trumbull Electric Manufacturing Company, Plainville, Conn. The circular also calls attention to the company's other line of residence panels from four to fourteen circuits on a composition base.

AIR FILTERS.—The Midwest Air Filters, Inc., Bradford, Pa., has issued a circular describing Midwest air filters in the central-station field. A description of the Midwest installation at the Pittsfield Electric Company, Pittsfield, Mass., is included.

GUY, MESSENGER AND SPAN WIRE. —Engineering data and wire tables covering Copperweld non-rusting guy, messenger and span wire is contained in publication No. E. D. 502 issued by the Copperweld Steel Company, Braddock P. O., Rankin, Pa.

BALL BEARINGS.—A pamphlet issued by the Standard Steel & Bearings, Inc., Plainville, Conn., entitled "Molybdenum means More-life-in-'em—why?" tells the story of the development and use of molybdenum steel for bearing purposes.

FLOODLIGHT FOR COLOR LIGHTING. —The Pittsburgh Reflector Company, Bowman Building, Third Avenue and Ross Street, Pittsburgh, has issued a bulletin describing the No. FLC-500 floodlight designed particularly for outdoor color lighting and for long-distance projection.

WELDING AND CUTTING APPARATUS.—The Purox Company, Denver, Col., has issued catalog No. 6 describing its gas welding and cutting apparatus. Attention is also called to its portable and stationary arc-welding equipment.

TELEPHONES.—Edwards & Company, Inc., has issued catalog No. 11, which describes and illustrates the various types of Edwards telephones.

FARM ELECTRIFICATION.—"The G-E Farm Book" (second edition) issued by the General Electric Company discusses the part that electricity can play on the farm and in the farm home and gives the answers to the question by word and picture in a broad way. Various applications of electricity are illustrated and described and a chapter is devoted to explaining the meaning of some of the common electrical terms.

STARTING SWITCH.—The Clark Controller Company, Cleveland, has issued bulletin No. 105 describing and illustrating the Clark type A starting switch and push-button. A complete dimension diagram and list of parts is included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Melbourne, Australia (No. 21,640), of neutral, direct-current, four-way and six-way relays.

Purchase is desired in Amsterdam, Netherlands (No. 21,641), of flashlights.

Purchase is desired in Amsterdam, Netherlands (No. 21,641), of motor-driven household devices, heating and cooking apparatus and electric scales.

Purchase is desired in Amsterdam, Netherlands (No. 21,641), of fractional horsepower motors.

Purchase and agency are desired in Santos, Brazil (No. 21,642), for electric household appliances.

An agency is desired in Singapore, Straits Settlements (No. 21,643), for coffee-grinding machines, capacity of 100 lb. per hour.

Purchase is desired in Bogota, Colombia (No. 21,647), of radio sets and parts.

Purchase or agency is desired in Zurich, Switzerland (No. 21,648), of small motors and motor-driven tools.

Purchase or agency is desired in Zurich, Switzerland (No. 21,648), of electric refrigerators.

Purchase or agency is desired in Zurich, Switzerland (No. 21,648), of electric household appliances.

An agency is desired in Vancouver, Canada (No. 21,673), for electric household appliances.

An agency is desired in Vancouver, Canada (No. 21,673), for electrical refrigerators.

Purchase is desired in Dessau, Germany (No. 21,678), of self-containing lighting outfits and lighting fixtures.

Purchase is desired in Dessau, Germany (No. 21,678), of electric water-heaters and electric wiring equipment.

Purchase or agency is desired in Singapore, Straits Settlements (No. 21,685), of electric refrigerators.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NORWICH, CONN. — Plans are under way by the Norwich Gas & Electric Company for the construction of a new hydro-electric plant at the south end of its present canal, to cost about $105,000.

EASTPORT, ME.—The Seacost Canning Company plans the installation of electric power equipment in connection with the proposed rebuilding of the portion of its local plant recently destroyed by fire, with loss of about $120,000.

CHICOPEE, MASS.—The Turners Falls Power & Electric Company, Turners Falls, plans extensions in its transmission lines to connect with the system of the Holyoke Power Company.

NEW BEDFORD, MASS. — The New York, New Haven & Hartford Railroad Company, New Haven, Conn., will install electric power equipment in its proposed local locomotive repair shops, estimated to cost $200,000.

WESTFIELD, MASS.—The Turners Falls Power Company has filed a petition to place under ground high-tension cables under the city dike and the Whitney playgrounds to connect with the power line which is being constructed from Westfield to Chester.

SPRINGFIELD, MASS. — The United Electric Light Company has plans under way for the construction of a proposed steam-operated electric power plant in the vicinity of its present local station, estimated to cost close to $1,000,000, with equipment. Transmission lines will be extended.

Middle Atlantic States

SMYRNA, DEL. — The Eastern Shore Gas & Electric Company, Laurel, plans the construction of a transmission line from Wyoming to Smyrna, by way of Chestwold, for light and power service.

WILMINGTON, DEL. — Electric power equipment will be installed at the proposed four-story ice manufacturing plant, to be constructed by the Diamond Ice & Coal Company at Vandever Avenue and Jessup Street, to cost approximately $150,000 with machinery. Brutus Gundlach, 452 Lexington Avenue, New York, is architect.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Aug. 27, for two Diesel engines; also, for plug fuses, sockets, extension bells, conduit elbows, and other miscellaneous electrical supplies (Panama Circular 1750).

CONOWINGO, MD.—A number of electric traveling cranes will be installed in the proposed hydro-electric generating plant of the Susquehanna Power Company.

LAWRENCEVILLE, N. J.—The Public Service Electric & Gas Company, Newark, has work under way on extensions and improvements in its local power substation.

PLAINFIELD, N. J.—The Public Service Electric & Gas Company, Newark, has filed plans for the construction of a one-story addition to its susbtation on West Second Street.

TRENTON, N. J.—The Public Service Electric & Gas Company, Newark, has work in progress on its proposed switching station near the city limits, to be equipped for a capacity of 70,000 hp.

UNION CITY, N. J.—Plans are under consideration for a new street-lighting system on Bergenline Avenue from Thirty-second Street to the Paterson Plankroad, Summit Avenue from Seventeenth to Sixth Street, and Thirty-second Street from Hudson Boulevard to Pleasant Street.

DOVER, N. J.—The New Jersey Power & Light Company will issue bonds for $950,000, a portion of the fund to be used for extensions and improvements.

NEWARK, N. J. — The Mono-Service Company, Verona Avenue and Oraton Street, manufacturer of paper products, will install electric power equipment in its proposed three-story addition, estimated to cost $200,000.

ALBANY, N. Y.—The Troy Gas Company has filed an application for approval of extension of its gas and electric system into the town of Waterford.

BALDWINSVILLE, N. Y. — Work will begin shortly on the enlarging of the plant of the Seneca River Power Company so that the local plant will be able to carry the entire Baldwinsville load in case of the failure of the Niagara power.

BAYSIDE, N. Y. — The American Ice Company, 41 East Forty-second Street, New York, will install electric power equipment in its proposed ice-manufacturing plants at Bayside and Great Neck, L. I., each to cost in excess of $200,000.

HAMPDEN, N. Y. — The New York State Gas & Electric Corporation plans extensions in transmission lines in this vicinity. The company has recently acquired the Hampden Electric Light Company and the Delancy Electric Light Company. A line will also be built from Belhi to Bloomville.

GLEN COVE, N. Y.—The Village Board of Trustees is planning to ask bids for the erection and construction of a modern five-alarm telegraph system throughout the town, to cost about $20,000.

SALINA, N. Y.—Plans of the Chemical Toilet Corporation, Syracuse, for the erection of a new factory building here, at a cost of $120,000, include a one-story power plant.

COPLAY, PA.—The Coplay Cement Manufacturing Company will install electric power equipment in connection with an expansion and improvement program, now under way at its local mill, to cost approximately $750,000.

PITTSBURGH, PA. — The Duquesne Light Company has secured permission to

construct a transmission tower on Twenty-sixth Street for supporting power lines crossing the Allegheny River.

RUTHERFORD HEIGHTS, PA. — The Board of Township Commissioners is considering a petition for the installation of an improved local lighting system.

TOPTON, PA.—Plans are under consideration by the Topton Electric Light & Power Company for the installation of a new street-lighting system.

HAMPTON ROADS, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 17, for 12,500 ft. lighting and power cable (Specification 5831)

NEWPORT NEWS, VA.—The Virginia Public Service Company has arranged for a stock issue of $1,600,000, a portion of the fund to be used for extensions and improvements in power plants and system. H. D. Polhemus is vice-president.

North Central States

CARLINVILLE, ILL. — The Illinois Power & Light Corporation plans to erect a 33,000-volt transmission power line from here to the Henderson mine in Macoupin County.

CHICAGO, ILL. — The Campbell Soup Company, Camden, N. J., will install electric power equipment in its proposed local plant on West Thirty-fifth and Rockwell Streets, estimated to cost $1,000,000, for which bids will be asked in the near future.

PINCKNEYVILLE, ILL.—The City Council will take bids soon on a white way system to cost about $6,000. There will be 50 lighting standards complete with glassware, etc., in the improvement.

ROBINSON, ILL.—The Lincoln Oil Refining Company has plans for a power house, also oil-pumping equipment, to cost $1,000,000.

SPRINGFIELD, ILL.—The Central Illinois Public Service Company has concluded negotiations for the purchase of three municipal electric power plants at Kinmundy, Middletown and Creal Springs, and for six privately owned power stations at Littleton, Farina, Mendon, Paloma, New Liberty and Coastburg. Extensions and improvements are contemplated.

INDIANAPOLIS, IND. — The Indianapolis Street Railway Company has plans under way for the construction of six automatic power substations in different sections of the city, estimated to cost $350,000.

DAVENPORT, IOWA.—The City Council has awarded contract to R. D. Speers, 329 West Third Street, Davenport, for street-lighting systems on Second Street from Western Avenue to Warren Street and on Forty-fourth Street from Pershing Avenue to Iowa Avenue, to cost $8,000. F. A. Hass is city clerk.

DURANT, IOWA.—The Iowa Electric Company, Cedar Rapids, is planning for the construction of a transmission line from Atalissa to Durant and vicinity, where power service will be furnished.

SPENCER, IOWA. — Bids will be received by the City Council until Aug. 23 for extensions and improvements in the municipal electric power plant and waterworks, including installation of additional equipment. Keffer & Jones, Masonic Temple, Des Moines, Iowa, are architects.

RUSSELLVILLE, KY.—The Atlas Rock & Asphalt Company, Inc., care of Peter B. Young, St. Joseph, Mo., president, plans the installation of electric power equipment at its proposed local plant, reported to cost close to $150,000.

GRAND RAPIDS, MICH. — The Luce Furniture Company will install electric power equipment in its proposed six-story addition on South Godfrey Avenue, estimated to cost about $900,000.

MENOMINEE, MICH. — The Northern Electric Company will proceed with the construction of a hydro-electric generating plant at White Rapids and Chalk Hill Rapids, Menominee County, to cost about $2,000,000, with transmission system.

CLOQUET, MINN. — The Northwest Paper Company plans the installation of electric power equipment in its new local mill addition, estimated to cost in excess of $100,000. The Jacobson Engineering Company, 430 Oak Grove Avenue, Minneapolis, Minn., is engineer.

FULTON, MO.—The A. P. Green Fire Brick Company, Mexico, Mo., contemplates the installation of electric power equipment at its proposed local plant, estimated to cost $250,000, for which plans are now under consideration.

SOUTHWEST CITY, MO.—The Electric Utilities Company, Joplin, Mo., is planning the construction of a transmission line for local light and power service. A substation will be installed.

FREMONT, NEB.—The Board of Public Works contemplates extensions and improvements in the municipal electric light and power plant to cost about $100,000, with equipment.

LINCOLN, NEB.—The Nebraska Gas & Electric Company is shortly to begin the construction of a 66,000-volt line from Plattsmouth, on the Missouri River, to Omaha, where it will connect with the plant of the Nebraska Power Company and will be utilized as standby and auxiliary equipment by both companies. A still further development will be the connection of Missouri Valley, Iowa, and Council Bluffs with a high-tension line about 30 miles in length.

LYMAN, NEB. — The Great Western Sugar Company, Sugar Building, Denver, Col., contemplates the construction of a power plant at its proposed local beet refinery. The entire project is estimated to cost close to $1,000,000.

GREEN BAY, WIS. — The Wisconsin Public Service Corporation will spend $57,000 to tie in its new Bayside steam plant with its hydro-electric properties. A high-tension line will be constructed west from the plant over the Duck Creek River for a distance of 4½ miles. Being a navigable river, it is necessary to conform with the requirements of the War Department in making this crossing. Wires will hang approximately 56 ft. above the water line.

LADYSMITH, WIS.—The North Electric Light & Power Company plans to build a transmission line to connect the two power plants it now has under construction in the towns of Exeland and Winter. Another transmission line to be built will extend over 30 miles from Exeland, Raddison, Stone Lake to Court d'Oreilles Lake.

CHIPPEWA FALLS, WIS.—Surveying operations have been started by the Northern States Power Company with a view to erecting a new hydro-electric station on the old dam site in Chippewa Falls which will augment the output of the Wissota dam.

LUBLIN, WIS.—The village has voted $3,500 to have Northern States Power Company build electric line to village. M. J. Zagorski is village clerk.

MAUSTON, WIS.—R. H. Davis & Son, Mauston, will build a hydro-electric plant on Lemonweir River, to cost $40,000. L. A. De Guere, Wisconsin Rapids, is the engineer.

Southern States

FOLEY, ALA.—Permission is asked for authority to construct a transmission line connecting the present plants in Foley, Robertsdale and Loxley with lines and all other necessary equipment to serve the unincorporated communities of Silverhill, Elberta, Magnolia Springs and Lillian.

OZARK, ALA.—The Gulf Electric Company, Mobile, plans extensions in transmission lines. The company has recently acquired the local municipal lighting plant.

BRADENTON, FLA.—The Florida Power & Light Company, Miami, plans the construction of a new transmission line to Sarasota, Fort Myers, and vicinity; additional substation apparatus is also contemplated.

LANTANA, FLA.—The Hollywood Electrical & Mechanical Engineering Company, Hollywood, has a contract for the installation of a white way system to cost $34,000.

LEE, FLA.—The Madison County Power Company, Madison, has contracted with the City Council for the installation of an ornamental lighting system in the downtown district.

MELBOURNE, FLA.—The Florida Power & Light Company will erect a modern ice plant estimated to cost $150,000.

PALMETTO, FLA. — The City Council plans the installation of a municipal electric lighting station for service for the proposed new street-lighting system.

ST. PETERSBURG, FLA.—The Pinellas County Power Company plans to construct two substations at Booker Creek and Third Street South and at First Avenue and Sixteenth Street, to cost $46,000.

SARASOTA, FLA.—E. J. Riley, care of A. S. Skinner Company, plans to erect an ice and cold-storage plant.

UMATILLA, FLA.—The Florida Public Service Company has acquired the local municipal electric power station and will furnish service here. Plans are under way for extensions in transmission lines.

ST. AUGUSTINE, FLA. — The Florida Power & Light Company, Miami, has plans under way for the construction of a new electric-operated ice-manufacturing plant on Riberia Street, with initial capacity of 50 tons per day, estimated to cost close to $100,000.

FLINTSTONE, GA.—The Yates Bleachery Company plans the installation of electric power equipment and other machinery to double the capacity of its mill, reported to cost in excess of $100,000.

TIFTON, GA.—The South Georgia Power Company, Albany, Ga., will make extensions and improvements in its local ice-manufacturing plant, including the installation of electric power and other equipment, estimated to cost $30,000.

QUITMAN, GA.—A development program of hydro-electric power in South Georgia is under way. The transmission line from Valdosta to Quitman will be rebuilt, also a line will be constructed from Valdosta to Waycross and from Valdosta to Lake City, Fla.

BATON ROUGE, LA.—The City Council has tentative plans under advisement for the installation of an ornamental lighting system in the business district, reported to cost in excess of $25,000.

BOGALUSA, LA.—The Great Southern Lumber Company plans the installation of electric power equipment in connection with the proposed rebuilding of its lumber and planing mill and box-manufacturing plant, recently destroyed by fire with loss of $500,000 including the machinery.

ELIZABETHTOWN, N. C. — The Tide Water Power Company, Wilmington, plans the construction of a power cable across Cape Fear River, for extending lines to White Lake and Garland.

McADENVILLE, N. C. — The Southern Power Company, Charlotte, N. C., has contracted with the McAden Mills for power supply at their local textile plant. Substation equipment will be installed. The power company has secured the rights to all water power heretofore used for the mill operation and will use in connection with a hydro-electric power development in the Indian Hook district.

SPRUCE PINE, N. C. — The Carolina Power & Light Company, Asheville, contemplates the construction of a transmission line for light and power service, with several branch lines in Yancey and Mitchell Counties.

CANTON, N. C. — The Pigeon River Power Company has a proposition under consideration for the erection of a $12,000,000 hydro-electric plant on the Big Pigeon River near the North Carolina line.

CUSHING, OKLA. — The City Council has called a special election on Aug. 17 to approve a bond issue of $13,000, for the installation of an ornamental lighting system in the business section.

MILBURN, OKLA.—The Oklahoma Gas & Electric Company, Oklahoma City, plans extensions in transmission lines. The local municipal lighting plant has been acquired and will be converted for substation service.

HUMBOLDT, TENN. — The Jackson Railway & Light Company, Jackson, will construct a high-tension line from Humboldt to Medina.

MOUNT PLEASANT, TENN.—The City Council has contracted with the Southern Cities Power Company, Chattanooga, for the installation of an ornamental lighting system in the business section.

BURNET, TEX.—The Texas Power & Light Company, Dallas, has authorized the construction of a transmission line from Lampasas to Burnet, Marble Falls and vicinity. Another transmission line will be built to Llano.

DALLAS, TEX.—The American Ice Company has authorized plans for the immediate construction of an ice-manufacturing plant at 3307 Lemmon Avenue, to replace works recently destroyed by fire. The entire plant will cost $150,000.

HARLINGEN, TEX.—The city plans to install an additional 750 hp. unit in its power plant; also a new street-lighting system in residence and business sections.

MARBLE FALLS, TEX. — The Marble Falls Textile Mills, Inc., is perfecting plans for the construction of a hydro-electric power plant on the Colorado River, to be used for service at its proposed local cotton mill. The station is reported to cost about $90,000.

SAN ANTONIO, TEX.—Immediate construction of 17 miles of high-tension transmission line between Dilley and Cotulla has been ordered by the Texas Central Power Company, and another line will be

built within a few months from Cotulla into the Winter Garden district.

VAL VERDE (El Paso), TEX. — The Val Verde Industries, Inc., plan the installation of electric power equipment at a proposed one-story canning plant, estimated to cost $115,000.

Pacific and Mountain States

TOMBSTONE, ARIZ.—The Bunker Hill Mining Company will install electric power equipment in a proposed concentrating mill at its local properties, reported to cost in excess of $125,000. Frank S. Morgan is superintendent.

LOS ANGELES, CAL.—The Board of County Supervisors has authorized plans for the installation of an ornamental lighting system on portions of El Tovar Place, Rangely Avenue and Dorrington Avenue, requiring in all about 114 pressed steel standards. Bids will soon be asked.

SAN FRANCISCO, CAL. — A hydroelectric plant is now being constructed on Bucks Creek, Plumas County, by the Feather River Power Company.

CULVER CITY, CAL.—The City Council has approved the installation of an ornamental lighting system on Washington Boulevard, from Centinela Boulevard to the west city limits, and on the same thoroughfare, from Inglewood Boulevard to Sepulveda Boulevard.

LOS ANGELES, CAL.—Property owners have petitioned the City Council to install ornamental lights on Berendo Avenue from Los Feliz Boulevard to Cromwell Avenue.

MINIDOKA, IDAHO.—Bids will be received by the Bureau of Reclamation, Denver, Col., until Sept. 1, for one hydraulic turbine to deliver 3,500 hp. under head of 47 ft., one 3,000-kva. generator, four 1,000-kva. transformers, switching apparatus, and four 33,000-volt oil circuit breakers, for the Minidoka power station.

ANACONDA, MONT.—Bids will be asked by the City Council before the close of the month for the installation of an ornamental lighting system on portions of Pine, Walnut, West Fourth, West Fifth and West Sixth Streets, in the downtown section.

BUTTE, MONT.—The City Council has adopted a resolution providing for the installation of an ornamental lighting system on East Broadway between Arizona and Thornton Avenues.

GLASGOW, MONT.—The Montana Power Company, Butte, contemplates the construction of a local substation in connection with a light and power system. A transmission line will be built from Malta, Mont. A proposition has been made to the city for the service, to be approved at a special election on Aug. 18.

GREAT FALLS, MONT.—The Montana Power Company, Butte, will construct a new power plant at Black Eagle Dam. The cost will be $1,000,000.

KALISPELL, MONT. — The Mountain States Power Company, Sandpoint, Idaho, plans the reconstruction of its power dam at Big Fork in connection with a hydroelectric power development estimated to cost $50,000.

LONGVIEW, WASH. — The Longview Fibre Company will construct a one-story substation at its proposed local mill on the Columbia River and has contracted with the Long-Bell Lumber Company for power supply from latter's local plant. The entire project will cost close to $2,000,000.

LOWELL, WASH.—The Watson Lumber Company plans the installation of electric power equipment in connection with the proposed rebuilding of the portion of its local mill, recently destroyed by fire, with loss reported at $500,000.

SEATTLE, WASH. — The Puget Sound Power & Light Company has plans nearing completion for the construction of a two-story substation, 32 ft. x 55 ft., at 620 Warren Avenue, to cost about $28,000.

Canada

FREDERICTON, N. B.—Capital expenditure for plant and equipment improvements to be made during the ensuing year in connection with the Maritime Electric Company's systems in Fredericton and St. Stephen, N. B., Charlottetown and Bridgeton, P.E.I., and in the State of Maine is approximately $150,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 20, 1926)

1,593,381. TUNGSTEN ARC LAMP; F. Blau, Berlin-Charlottenburg, near Berlin, Germany. App. filed April 14, 1921.

1,593,384. ELECTROMAGNET; H. W. Brown, Schenectady, N. Y. App. filed Feb. 13, 1926. For electro-responsive devices, such as protective relays, whereby desired changes in the operation of the device, such as the relation between the currents necessary to attract and relase an electromagnetically actuated member and the value of the current necessary to attract the member, are greatly faciliated.

1,593,386. CIRCUIT CONTROLLER; F. A. Byles, Schenectady, N. Y. App. filed Oct. 9, 1924. For farm lighting plant.

1,593,389. CONTROLLER; A. T. Crocker, Schenectady, N. Y. App. filed Sept. 23, 1924. Means whereby the initial return movement of a controller operating means toward the off or neutral position will open the energizing circuit of an electro-responsive circuit closing device so that the breaking of the circuit controlled by the controller will not occur at the main controller contacts.

1,593,392. ADJUSTING SCREW FOR PULL-CHAIN SOCKETS AND THE LIKE; F. C. De Reamer, Bridgeport, Conn. App. filed Dec. 2, 1921.

1,593,397. PROCESS AND APPARATUS FOR ELECTRODEPOSITION; T. Robinson, New York, N. Y. App. filed Aug. 5, 1924. For the electrolytic application of a plating upon a non-metallic surface, and also for the production of metallic articles by deposition on a cathode from which these articles are later stripped.

1,593,400. FREQUENCY CONVERTER; C. M. Gilt, Brooklyn, N. Y. App. filed May 14, 1923. A type of frequency converter which makes it possible to change the speed of the converter through synchronism when it is tied to one of the systems only, thereby making it possible to synchronize the set with the other system without any adjustment of the generating units which supply the system. By means of an adjustment of the control of the set, the amount and direction of the load transfer can be sufficiently varied at will by the operator at the set.

1,593,403. SYSTEM OF CONTROL; M. R. Hanna, Scotia, N. Y. App. filed April 14, 1924. Whereby a direct-current motor having shunt characteristics may be safely operated in connection with a dynamotor from a source of supply subject to violent fluctuations.

1,593,404. ELECTRIC MOTOR CONTROL; H. C. Hastings, Rugby, England. App. filed Nov. 13, 1923. Wherein the contactors for controlling the starting resistance and the series-parallel connections of the motors are operated by cams mounted on a shaft.

1,593,405. FLUID-BREAK SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed May 27, 1924. Of relatively large capcity and adapted to control high-potential circuits. A fluid-break switch having means for reducing the condensation of moisture in the presence of the insulating liquid thereof due to atmosnheric changes. Means for removing moisture from air taken into the switch and means for preventing an outward rush of material from said switch through said moisture removing means.

1,593,434. ELECTRIC SWITCH; J. R. Carlson, Hartford, Conn. App. filed Nov. 10, 1922. Of the four-point or pole-changing type.

1,593,476. CIRCUIT INTERRUPTER; G. Speiser, Nuremberg, Germany. App. filed July 23, 1925. Having automatic means for tripping the same under predetermined conditions. The overload and low-voltage tripping devices of the interrupter are combined, the latter being retarded in its operation and the former being arranged to short-circuit the low-voltage device to obtain a retarded operation on moderate overloads and arranged to trip the interrupter directly to open the circuit instantaneously on extreme overloads.

1,593,534. ELECTRIC RECEPTACLE; A. L. Kuhlman, Bay City, Mich. App. filed Feb. 8, 1923. An instantaneous connect and disconnect electrical receptacle, so that all forms of attachments or fittings, such as used on percolators, irons, lamps, and other electrical equipment will fit thereinto, and eliminate the necessity of the various forms and designs of fittings and attachments at present in general use.

(Issued July 27, 1926)

1,593,570. STAND-LAMP CONSTRUCTION; J. M. Curliss, Chicago, Ill. App. filed June 5, 1924. Means for controlling a stand lamp cluster provided with switches.

1,593,626. MEASURING INSTRUMENT; E. B. Foote, Rochester, N. Y. App. filed Oct. 3, 1924. Means for controlling an electric meter in circuit with a temperature sensitive element and with a balance resistance forming a Wheatstone bridge arrangement, for measuring temperatures. For indicating directly in terms of degrees of temperature.

1,593,638. CONTROLLING DEVICE FOR ELECTRIC FLATIRONS; C. L. Moyer, Chicago, Ill. App. filed Jan. 12, 1925. Means for automatically preheating and for maintaining the temperature by hand control.

1,593,649. SWITCH SHELL; T. A. Both, Stratford, Conn. App. filed Oct. 31, 1919.

1,593,659. CONTROLLING MECHANISM FOR ALTERNATING-CURRENT MOTORS; R. G. Standerwick, Marblehead, Mass. App. filed July 30, 1925. Whereby an alternating-current motor may be reversed as to direction of rotation and run satisfactorily in both directions without the making or breaking of any contacts.

1,593,661. POSITIONING AND ROTATING MEANS FOR ELECTRODES; A. C. Maby, Richmond Hill, N. Y. App. filed April 1, 1918. Means for controlling electrode-feed mechanism for such projectors.

1,593,723. RENEWABLE INCLOSED ELECTRIC FUSE; J. Sachs, Hartford, Conn. App. filed Feb. 19, 1925.

1,593,725. SELF-CONTAINED HEATER UNIT; W. A. Sharpe, Denver, Col. App. filed Jan. 9, 1926.

1,593,760. DEVICE FOR PROTECTING ELECTRIC CIRCUITS FROM OVERHEATING; O. Dreyer, Essen-on-the-Ruhr, Germany. App. filed April 25, 1924. A sleeve or casing having a pin-switch or contact rod which is soldered therein with easily fusible material, and when the solder softens, is pressed forwards by means of a spring and thereby initiates the process of disconnection.

1,593,819. SPEED REGULATOR; H. G. Dorsey, Gloucester, Mass. App. filed Aug. 8, 1919. Means for maintaining the speed of an electrical unit substantially constant; to provide means responsive to load variations in an alternating-current circuit for regulating the speed of the machine from which the power is derived; to provide means for automatically varying the inductance of an alternating-current circuit and thereby controlling the speed of the machine from which the power is derived.

1,593,824. METHOD OF AND MACHINE FOR FORMING AND MOUNTING FILAMENTS; J. J. Higgins, East Orange, N. J. App. filed Nov. 10, 1922.

1,593,879. ELECTRIC FURNACE; J. J. Naugle, Brooklyn, N. Y. App. filed April, 21, 1923. As intended for the treatment of comminuted carbonaceous or other material, which shall permit the substantially continuous production of material of a high degree of purity.

1,593,896. ELECTRIC STEAM PRESSING IRON; C. A. Brewer, Norton Heights, Conn. App. filed Oct. 24, 1924.

1,593,901. AUTOMATIC CAR SAFETY SWITCH; T. Eskilsson, New York, N. Y. App. filed Feb. 6, 1923. For use in connection with passenger elevators and like structures.

1,593,912. CARBON-FEEDING MECHANISM FOR ARC LAMPS; E. G. Perkins, Youngstown, Ohio. App. filed July 18, 1922.

1,593,925. CIRCUIT CLOSER; C. L. Abalsamo, Buenos Aires, Argentina. App. filed Nov. 6, 1924. Means for controlling the lighting and extinguishing of indicating incandescent lamps particularly in connection with scales.

1,593,927. HEADLIGHT SWITCH AND BOX; C. H. Bissell, Syracuse, N. Y. App. filed Dec. 13, 1922. Switch is particularly designed for locomotive headlights and to be mounted in the cab of the locomotive along the window sill.

1,593,966. TRAIN-LIGHTING SYSTEM; J. H. Davis, Baltimore, Md. App. filed Aug. 13, 1925. Under normal conditions the train is lighted from a generator on the locomotive.

1,593,985. SOCKET AND PLUG CONNECTION FOR ELECTRIC CIRCUITS; A. Nielsen, Christiania, Norway. App. filed March 24, 1923.